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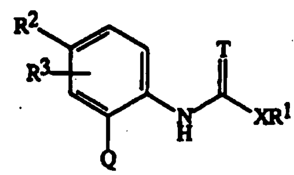
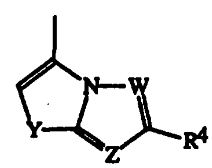
(54) Title: HERBICIDAL HETEROARYL-SUBSTITUTED ANILIDES

(57) Abstract

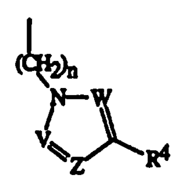
Compounds of formula (I), and their -oxides and agriculturally-suitable salts, are disclosed which are useful for controlling undesired vegetation. In said formula, Q is (Q-1), (Q-2), (Q-3), T is O or S; X is a single bond, O, S, or NR^5; Y is O, S, NR^6, -CH=CH-, or -CH=N-, where the -CH=N- can be attached in either possible orientation; Z is CH or N; W is CH or N; V is CH, CCH_3 or N, provided that V is CH or CCH_3 when W is CH; n is 0 or 1; and R^1-R^6 are as defined in the disclosure. Also disclosed are compositions containing the compounds of formula (I) and a method for controlling undesired vegetation which involves contacting the vegetation or its environment with an effective amount of a compound of formula (I).



(I)



(Q-1)



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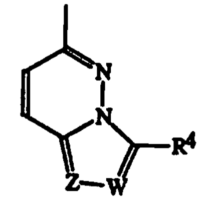

(Q-3)

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TITLE

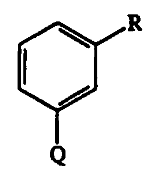
HERBICIDAL HETEROARYL-SUBSTITUTED ANILIDES

BACKGROUND OF THE INVENTION

This invention relates to certain heteroaryl-substituted anilides, their *N*-oxides, agriculturally-suitable salts of the anilides and compositions, and methods of their use for controlling undesirable vegetation.

The control of undesired vegetation is extremely important in achieving high crop efficiency. Achievement of selective control of the growth of weeds especially in such useful crops as rice, soybean, sugar beet, corn (maize), potato, wheat, barley, tomato and plantation crops, among others, is very desirable. Unchecked weed growth in such useful crops can cause significant reduction in productivity and thereby result in increased costs to the consumer. The control of undesired vegetation in noncrop areas is also important. Many products are commercially available for these purposes, but the need continues for new compounds which are more effective, less costly, less toxic, environmentally safer or have different modes of action.

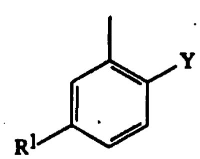
WO 93/11097 discloses anilides of Formula i as herbicides:



i

wherein

Q is, among others, Q-1



;

Q-1

R is, among others, C_1-C_2 haloalkyl, C_1-C_2 haloalkoxy, C_1-C_2 haloalkylthio, halogen, cyano, or nitro;

Y is $NR^7C(O)XR^3$;

X is a single bond, O, S or NR^4;

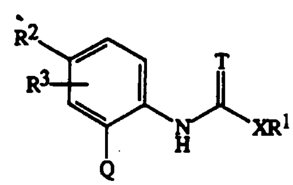
R^1 is, among others, H, C_1-C_3 alkyl, C_1-C_3 alkoxy, C_1-C_3 alkylthio, C_2-C_3 alkoxyalkyl, C_2-C_3 alkylthioalkyl, halogen, NO_2, CN, NHR^5 or NR^5R^6; and

R^3 is, among others, C_1-C_5 alkyl optionally substituted with C_1-C_2 alkoxy, OH, 1-3 halogen, or C_1-C_2 alkylthio; CH_2(C_3-C_4 cycloalkyl); C_3-C_4 cycloalkyl optionally substituted with 1-3 CH_3's; C_2-C_4 alkenyl; or C_2-C_4 haloalkenyl.

The heteroaryl-substituted anilides of the present invention are not disclosed therein.

SUMMARY OF THE INVENTION

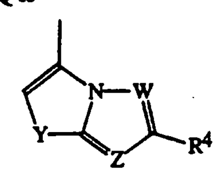
This invention is directed to compounds of Formula I, geometric isomers, stereoisomers, *N*-oxides, and agriculturally suitable salts thereof as well as agricultural compositions containing them and their use for controlling undesirable vegetation:



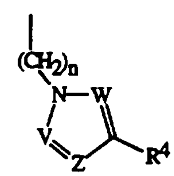
I

wherein

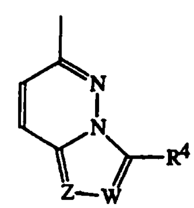
Q is



Q-1



Q-2



Q-3

T is O or S;

X is a single bond, O, S, or NR^5;

Y is O, S, NR^6, -CH=CH-, or -CH=N-, where the -CH=N- can be attached in either possible orientation;

Z is CH or N;

W is CH or N;

V is CH, CCH_3 or N, provided that V is CH or CCH_3 when W is CH;

R^1 is C_1-C_5 alkyl optionally substituted with C_1-C_2 alkoxy, OH, 1-7 halogen, or C_1-C_2 alkylthio; CH_2(C_3-C_4 cycloalkyl); C_3-C_6 cycloalkyl optionally substituted with 1-3 halogen or 1-4 methyl groups; C_2-C_4 alkenyl; C_2-C_4 haloalkenyl; or phenyl optionally substituted with C_1-C_4 alkyl, C_1-C_4

haloalkyl, C_1-C_4 alkoxy, 1-2 halogen, nitro, or cyano; provided that when X is O, S, or NR^5, then R^1 is other than C_2 alkenyl and C_2 haloalkenyl;

R^2 is H, halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, C_1-C_2 alkylthio, C_2-C_3 alkoxyalkyl, C_2-C_3 alkylthioalkyl, cyano, nitro, $NH(C_1$-C_2 alkyl), or $N(C_1$-C_2 alkyl$)_2$;

R^3 is H, halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, C_1-C_2 alkylthio, C_2-C_3 alkoxyalkyl, C_2-C_3 alkylthioalkyl, cyano, nitro, $NH(C_1$-C_2 alkyl), or $N(C_1$-C_2 alkyl$)_2$;

R^4 is C_1-C_4 haloalkyl, C_1-C_4 haloalkoxy, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, halogen, cyano, or nitro;

R^5 is H, CH_3, or OCH_3;

R^6 is H or CH_3; and

n is 0 or 1.

In the above recitations, the term "alkyl", used either alone or in compound words such as "alkylthio" or "haloalkyl" includes straight-chain or branched alkyl, such as, methyl, ethyl, *n*-propyl, *i*-propyl, or the different butyl or pentyl isomers. The term "1-4 methyl groups" indicates that one to four of the available positions for that substituent may be methyl. "Alkenyl" includes straight-chain or branched alkenes such as vinyl, 1-propenyl, 2-propenyl, and the different butenyl isomers. "Alkenyl" also includes polyenes such as 1,2-propadienyl. "Alkoxy" includes, for example, methoxy, ethoxy, *n*-propyloxy, isopropyloxy and the different butoxy isomers. "Alkoxyalkyl" denotes alkoxy substitution on alkyl. Examples of "alkoxyalkyl" include CH_3OCH_2, $CH_3OCH_2CH_2$ and $CH_3CH_2OCH_2$. "Alkylthio" includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio and butylthio isomers. "Alkylthioalkyl" denotes alkylthio substitution on alkyl. Examples of "alkylthioalkyl" include CH_3SCH_2, $CH_3SCH_2CH_2$ and $CH_3CH_2SCH_2$. Examples of "alkylsulfonyl" include $CH_3S(O)_2$, $CH_3CH_2S(O)_2$, $CH_3CH_2CH_2S(O)_2$, $(CH_3)_2CHS(O)_2$ and the different butylsulfonyl isomers. "Cycloalkyl" includes, for example, cyclopropyl, cyclobutyl, cyclopentyl, and cyclohexyl. One skilled in the art will appreciate that not all nitrogen containing heterocycles can form *N*-oxides since the nitrogen requires an available lone pair for oxidation to the oxide; one skilled in the art will recognize those nitrogen containing heterocycles which can form *N*-oxides.

The term "halogen", either alone or in compound words such as "haloalkyl", includes fluorine, chlorine, bromine or iodine. The term "1-7 halogen" indicates that one to seven of the available positions for that substituent may be halogen which are independently selected; the terms "1-3 halogen" and "1-2 halogen" are defined analogously. Further, when used in compound words such as "haloalkyl", said alkyl may be partially or fully substituted with halogen atoms which may be the same or different.

Examples of "haloalkyl" include F_3C, $ClCH_2$, CF_3CH_2 and CF_3CCl_2. The terms "haloalkenyl", "haloalkoxy", and the like, are defined analogously to the term "haloalkyl". Examples of "haloalkenyl" include $(Cl)_2C{=}CHCH_2$ and $CF_3CH{=}CHCH_2$. Examples of "haloalkoxy" include CF_3O, CCl_3CH_2O, $HCF_2CH_2CH_2O$ and CF_3CH_2O. Examples of "haloalkylthio" include CCl_3S, CF_3S, CCl_3CH_2S and $ClCH_2CH_2CH_2S$. Examples of "haloalkylsulfonyl" include $CF_3S(O)_2$, $CCl_3S(O)_2$, $CF_3CH_2S(O)_2$ and $CF_3CF_2S(O)_2$.

The total number of carbon atoms in a substituent group is indicated by the "C_i-C_j" prefix where i and j are numbers from 1 to 5. For example, C_1-C_3 alkylsulfonyl designates methylsulfonyl through propylsulfonyl; C_2 alkoxyalkyl designates CH_3OCH_2; and C_3 alkoxyalkyl designates, for example, $CH_3CH(OCH_3)$, $CH_3OCH_2CH_2$ or $CH_3CH_2OCH_2$.

When a group contains a substituent which can be hydrogen, for example R^2 or R^5, then, when this substituent is taken as hydrogen, it is recognized that this is equivalent to said group being unsubstituted.

Compounds of this invention can exist as one or more stereoisomers. The various stereoisomers include enantiomers, diastereomers, atropisomers and geometric isomers. One skilled in the art will appreciate that one stereoisomer may be more active and/or may exhibit beneficial effects when enriched relative to the other stereoisomer(s) or when separated from the other stereoisomer(s). Additionally, the skilled artisan knows how to separate, enrich, and/or to selectively prepare said stereoisomers. Accordingly, the present invention comprises compounds selected from Formula I, *N*-oxides and agriculturally suitable salts thereof. The compounds of the invention may be present as a mixture of stereoisomers, individual stereoisomers, or as an optically active form.

The salts of the compounds of the invention include acid-addition salts with inorganic or organic acids such as hydrobromic, hydrochloric, nitric, phosphoric, sulfuric, acetic, butyric, fumaric, lactic, maleic, malonic, oxalic, propionic, salicylic, tartaric, 4-toluenesulfonic or valeric acids. The salts of the compounds of the invention also include those formed with organic bases (e.g., pyridine, ammonia, or triethylamine) or inorganic bases (e.g., hydrides, hydroxides, or carbonates of sodium, potassium, lithium, calcium, magnesium or barium) when the compound contains an acidic group.

Preferred compounds for reasons of better activity and/or ease of synthesis are:

Preferred 1. Compounds of Formula I above, and *N*-oxides and agriculturally-suitable salts thereof, wherein:

R^1 is C_1-C_4 alkyl optionally substituted with methoxy or 1-3 halogen; C_3-C_4 cycloalkyl optionally substituted with one methyl group; C_2-C_4 alkenyl; or C_2-C_4 haloalkenyl;

R^2 is chlorine, bromine, C_1-C_2 alkyl, C_1-C_2 alkoxy, cyano, nitro, $NH(C_1$-C_2 alkyl), or $N(C_1$-C_2 alkyl$)_2$; and

R^3 is H.

Preferred 2: Compounds of Preferred 1 wherein:

X is a single bond; and

R^4 is C_1-C_2 haloalkyl, C_1-C_2 haloalkoxy, C_1-C_2 haloalkylthio, chlorine, or bromine.

Preferred 3: Compounds of Preferred 2 wherein:

Q is Q-1.

Preferred 4: Compounds of Preferred 2 wherein:

Q is Q-2.

Preferred 5: Compounds of Preferred 2 wherein:

Q is Q-3.

Most preferred are compounds of Preferred 2 selected from the group:

3-methyl-*N*-[4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]phenyl]butanamide;

N-[4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]phenyl]cyclopropanecarboxamide;

2-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]propanamide;

N-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]cyclopropanecarboxamide;

3-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]butanamide;

2-methyl-*N*-[4-methyl-2-[[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]methyl]phenyl]propanamide; and

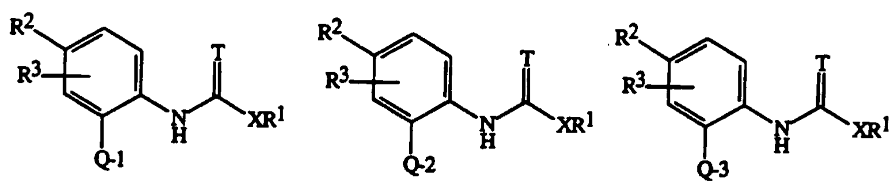
2,2-dimethyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1,2,4-triazolo[4,3-*b*]pyridazin-6-yl]phenyl]propanamide.

This invention also relates to herbicidal compositions comprising herbicidally effective amounts of the compounds of the invention and at least one of a surfactant, a solid diluent or a liquid diluent. The preferred compositions of the present invention are those which comprise the above preferred compounds.

This invention also relates to a method for controlling undesired vegetation comprising applying to the locus of the vegetation herbicidally effective amounts of the compounds of the invention (e.g., as a composition described herein). The preferred methods of use are those involving the above preferred compounds.

DETAILS OF THE INVENTION

The compounds of Formula I can be prepared by one or more of the following methods and variations as described in Schemes 1-34. The definitions of Q, T, X, Y, Z, W, V, R^1-R^6 and n in the compounds of Formulae 1-48 below are as defined above in the Summary of the Invention. Compounds of Formulae Ia-Ic are various subsets of the compounds of Formula I, and all substituents for Formulae Ia-Ic are as defined above for Formula I.

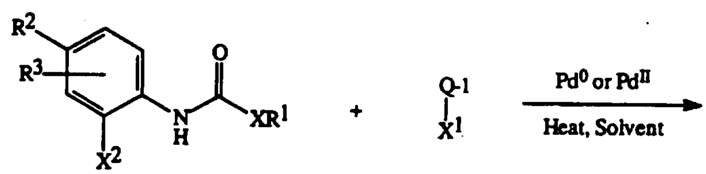


Ia Ib Ic

Scheme 1 illustrates the preparation of compounds of Formula Ia where T = O whereby substituted phenyl compounds of Formula 1a wherein X^2 is trialkyltin (e.g., Me_3Sn), trialkylsilyl (e.g., Me_3Si), or a boronic acid derivative (e.g., $B(OH)_2$) are coupled with heterocycles of Formula 2a wherein X^1 is chlorine, bromine, iodine or trifluoromethylsulfonyloxy (OTf). The coupling is carried out by methods known in the art: for example, see Tsuji, J., *Organic Synthesis with Palladium Compounds*, Springer-Verlag, Berlin (1980); Negishi, E., *Acc. Chem. Res.* (1982), *15*, 340; Stille, J. K., *Angew. Chem.* (1986), *98*, 504; Yamamoto, A. and Yamagi, A., *Chem. Pharm. Bull.* (1982), *30*, 1731 and 2003; Dondoni et al., *Synthesis* (1987), 185; Dondoni et al., *Synthesis* (1987), 693; Hoshino et al., *Bull. Chem. Soc. Jpn.* (1988), *61*, 3008; Sato, M. et al., *Chem. Lett.* (1989), 1405; Miyaura et al., *Synthetic Commun.* (1981), *11*, 513; Siddiqui and Sniekus, *Tetrahedron Lett.* (1988), *29*, 5463; Sharp at al., *Tetrahedron Lett.* (1987), *28*, 5093; Hatanaka et al., *Chem. Lett.* (1989), 1711; Bailey, T. R., *Tetrahedron Lett.* (1986), *27*, 4407; Echavarren, A. M. and Stille, J. K., *J. Am. Chem. Soc.* (1987), *109*, 5478; and Ali et al., *Tetrahedron Lett.* (1992), *48*, 8117. The coupling of 1a and 2a is carried out by heating the mixture in the presence of a transition metal catalyst such as tetrakis(triphenylphosphine) palladium(0) or bis(triphenylphosphine)-palladium (II) dichloride in a solvent such as toluene, acetonitrile, glyme, or

tetrahydrofuran optionally in the presence of an aqueous inorganic base such as sodium hydrogen carbonate or an organic base such as triethylamine. One skilled in the art will recognize that when 2a contains more than one reactive substituent, then the stoichiometric ratios of reagents will need to be adjusted to minimize bis-coupling.

SCHEME 1

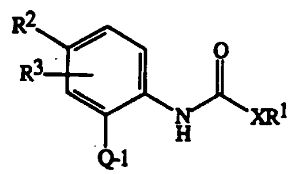


1a: X^2 = trialkyltin, trialkylsilyl, or a boronic acid derivative

1b: X^2 = Cl, Br, I, or OTf

2a: X^1 = Cl, Br, I, or OTf

2b: X^1 = trialkyltin, trialkylsilyl, or a boronic acid derivative



Ia (T = O)

Conversely, the anilides of Formula Ia where T = O can be prepared by reversing the reactivity of the two substrates. Substituted phenyl compounds of Formula 1b wherein X^2 is chlorine, bromine, iodine or trifluoromethylsulfonyloxy (OTf) can be coupled with heteroaromatic compounds of Formula 2b wherein X^1 is trialkyltin (e.g., Me_3Sn), trialkylsilyl (e.g., Me_3Si), or a boronic acid derivative (e.g., $B(OH)_2$). The procedure for conducting the coupling is the same as those described and referenced above.

By methods also reported in the above cited literature, compounds of Formula 1a and 2b are prepared by treating the corresponding halide (i.e., wherein X^1 and X^2 is bromine or iodine) with a metalating agent such as *n*-butyllithium followed by quenching with a trialkyltin halide, trialkylsilyl halide, boron trichloride, or trialkyl borate.

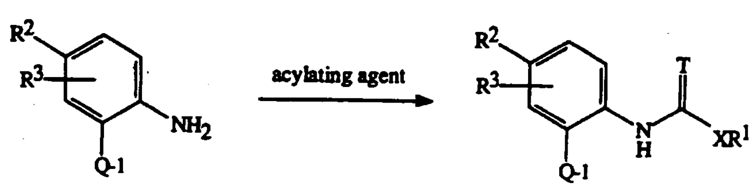
Some compounds of Formula 1a can also be prepared from the corresponding *ortho*-unsubstituted compound (i.e., wherein X^2 is hydrogen) by treatment with a base such as *n*-butyllithium followed by quenching with a trialkyltin halide, trialkylsilyl halide, or trialkyl borate as reported in the same literature references. This preparation requires

that $-NHC(=O)XR^1$ is an *ortho*-metalation directing group known in the art (e.g., trimethylacetylamido): see for example, Fuhrer, W., *J. Org. Chem.* (1979), *44*, 1133.

Anilides and heteroaromatics of Formulae 1 and 2 wherein X^1 and X^2 are chlorine, bromine, iodine, OTf, and hydrogen are either known or readily prepared by procedures and techniques well known in the art, for example: D. E. Pereira, et al., *Tetrahedron* (1987), *43*, 4931-4936; K. Senga, et al., *J. Med. Chem.* (1981), *24*, 610-613; T. Novinson, et al., *J. Med. Chem.* (1976), *19*, 512-516; Makisumi, K., *Chem. Pharm. Bull.* (1959), *7*, 907, 909; Sirakawa, *Yakugaku Zasshi* (1959), *79*, 903, 907; J. J. Kaminski, et al., *J. Med. Chem.* (1987), *30*, 2047-2051; E. S. Hand, et al., *J. Org. Chem.* (1980), *45*, 3738-3745; Finkelstein, B. L., *J. Org. Chem.* (1992), *57*, 5538-5540; Tschitschibabin, D. R. P. 464,481; C. Sablayrolles, et al., *J. Med. Chem.* (1984), *27*, 206-212; Vercek et al., *Tetrahedron Lett.* (1974), 4539; and S. Polanc, et al., *J. Org. Chem.* (1974), *39*, 2143-2147.

Compounds of Formula Ia can also be prepared by one skilled in the art from anilines of Formula 3 by treatment with an appropriate acyl chloride or acid anhydride (T = O, X = direct bond), chloroformate (T = O, X = O), chlorothiolformates (T = O, X = S), carbamoyl chloride (T = O, X = NR^5), isothiocyanate (T = S, X = NH), isocyanate (T = O, X = NH) or xanthyl chlorides (T = S, X = S) under conditions well known in the literature, for example: Sandler, R. S. and Karo, W., *Organic Functional Group Preparations*, 2nd Edition, *Vol. I*, p 274 and *Vol. II*, pp 152, 260, Academic Press (Scheme 2).

SCHEME 2

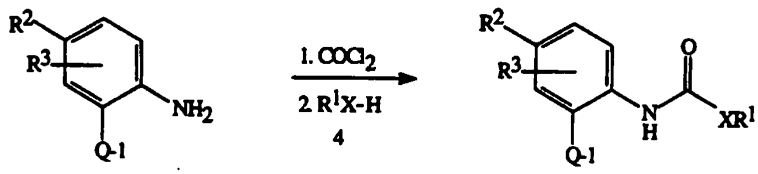


3 Ia

Alternatively, anilines of Formula 3 can be converted into the corresponding isocyanate by treatment with phosgene or known phosgene equivalents (e.g., $ClC(=O)OCCl_3$), and then condensed with an appropriate alcohol or amine of Formula 4 to afford anilides of Formula Ia (Scheme 3). These techniques are well known in the literature. For example, see Sandler, R. S. and Karo, W., *Organic Functional Group Preparations*, 2nd Edition, *Vol. II*, 152, 260, Academic Press;

Lehman, G. and Teichman, H. in *Preparative Organic Chemistry*, 472, Hilgetag, G. and Martini, A., Eds., John Wiley & Sons, New York, (1972); Eckert, H. and Forster, B., *Angew. Chem., Int. Ed.* (1987), *26*, 894; Babad, H. and Zeiler, A. G., *Chem. Rev.* (1973), *73*, 75.

SCHEME 3



3

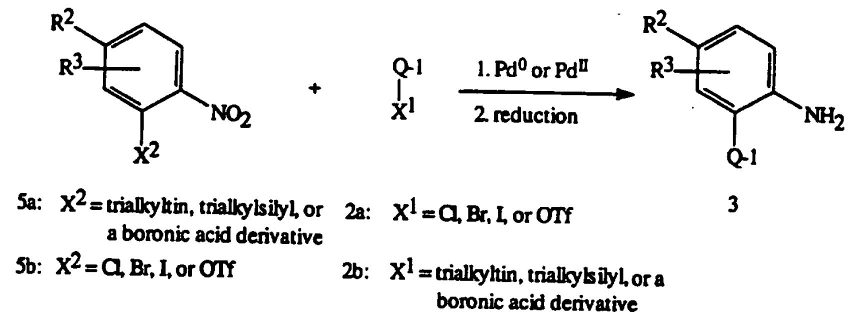
Ia (T=O)

In some cases, it is desirable to perform the palladium coupling reaction on an *N*-protected form of the aniline, for example the 2,2-dimethylpropanamide. Upon completion of the coupling reaction, the *N*-protecting group can be removed, for example by treatment of the 2,2-dimethylpropanamide with acid, to liberate the amino group.

Anilines of Formula 3 are readily prepared by palladium catalyzed coupling of an *ortho*-substituted nitrophenyl compound of Formula 5a, wherein X^2 is as defined above, with a heteroaromatic compound of Formula 2a, wherein X^1 is as defined above, followed by catalytic or chemical reduction of the nitro group (Scheme 4). As described for Scheme 1, the reactivity of the substrates can be reversed, i.e., the coupling is carried out using an *ortho*-substituted nitrophenyl compound of Formula 5b and a heteroaromatic compound of Formula 2b.

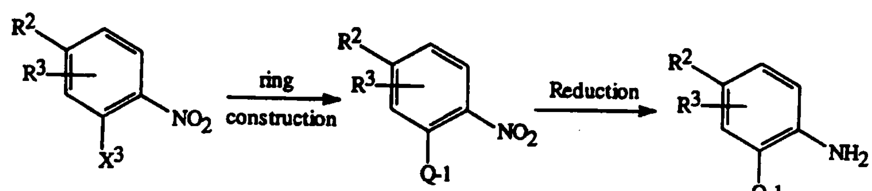
Reduction of nitro groups to amino groups is well documented in the chemical literature. See for example, Ohme, R. and Zubek, A. R. and Zubek, A. in *Preparative Organic Chemistry*, 557, Hilgetag, G. and Martini, A., Eds., John Wiley & Sons, New York: (1972).

SCHEME 4



In other cases, it is advantageous to prepare compounds of Formula 3, not by the cross-coupling methods described above, but rather by elaboration of a *ortho*-substituted nitrophenyl compound of Formula 6, under any of a number of ring closure methodologies (Scheme 5). Subsequent reduction of the nitro compounds of Formula 7 provides compounds of Formula 3.

SCHEME 5

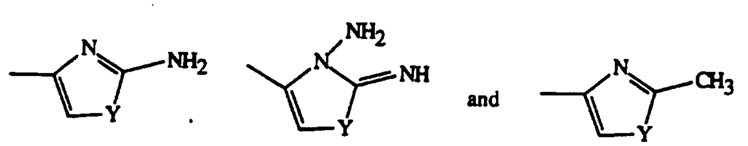


6 7 3

wherein

X^3 can be any of a number of heterocycle building blocks, including, but not limited to those shown below:

X^3 = $COCH_2NH_2$, $COCH_2$-halogen,

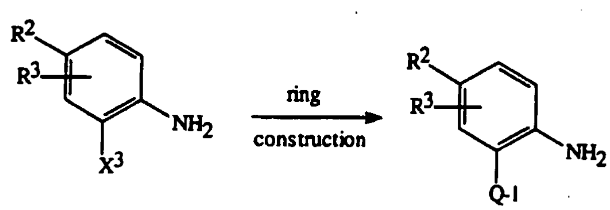


Compounds of Formula 6 are well known in the art or may be made by simple functional group interconversions on *ortho*-substituted nitrophenyl compounds.

Numerous methods for conversion of these X^3 substituents into Q-1 heterocycles are well known in the literature and can be applied by those skilled in the art for the preparation compounds of Formula 7. For example, see Katritzky, A. R. and Rees, C. W., *Comprehensive Heterocyclic Chemistry, Vol. 6*, pp. 992-993, Pergamon Press, London (1984); Flament et al., *Helv. Chim. Acta.* (1977), *60*, 1872-1882; Kasuga et al., *Yakugaku Zasshi* (1974), *94*, 952-962; E. Abignente, et al., *J. Heterocycl. Chem.* (1986), *23*, 1031-1034; O. Chavignon, et al., *J. Heterocycl. Chem.* (1992), *29*, 691-697; Buchan et al., *J. Org. Chem.* (1977), *42*, 2448-2451; Allen et al. *J. Org. Chem.* (1959), *24*, 796-801; Balicki, R., *Pol. J. Chem.* (1983), *57*, 1251-1261; J. P. Dusza, et al., U.S. 4178449; D. W. Hansen Jr., et al., World Patent Publication WO 91/08211; M. L. Bode, et al., *J. Chem. Soc., Perkin Trans. 1* (1993), 1809-1813; I. Anitha, et al., *J. Indian Chem. Soc.* (1989), *66*, 460-462; Y. Tominaga, et al., *J. Heterocycl. Chem.* (1989), *26*, 477-487; S. Branko, et al., *J. Heterocycl. Chem.* (1993), *30*, 1577; M. Mukoyama, Jpn. Kokai Tokkyo Koho JP 06 16667; Y.Tominaga, et al., *Heterocycles* (1988), *27*, 2345-2348; P. L. Anderson, et al., *J. Heterocycl. Chem.* (1981), *18*, 1149-1152; F. Compernolle, et al., *J. Heterocycl. Chem.* (1986), *23*, 541-544; L. F. Miller, et al., *J. Org. Chem.* (1973), *38*, 1955-1957; R. Faure, et al., *Tetrahedron* (1976), *32*, 341-348; A. Terada, Eur. Pat. Appl. EP-A-353,047; Reid, D. H., *J. Chem. Soc., Perkin Trans. 1* (1979), 2334-2339; J. C. Brindley, et al; *J. Chem. Soc., Perkin Trans. 1* (1986), 1255-1259; R. L. Harris, et al., *Aust. J. Chem.* (1986), *39*, 887-892; J. P. Henichart, et al., *J. Heterocycl. Chem.* (1986), *23*, 1531-1533; I. A. Mazur, et al., *Chem. Heterocycl. Compd.* (1970), *6*, 474-476; I. A. Mazur, et al., *Khim. Geterotsikl. Soedin.* (1970), 512-514; Meakins, G. D., *J. Chem. Soc., Perkin Trans. 1* (1989), 643-648; and E. Campaigne, et al., *J. Heterocycl. Chem.* (1978), *15*, 401-411.

One skilled in the art will recognize that these same ring closure methodologies can be used to elaborate an *ortho*-substituted aniline of Formula 8, or a derivative thereof, into compounds of Formula 3 (Scheme 6). This strategy is illustrated in Examples 1 and 2.

SCHEME 6



8 3

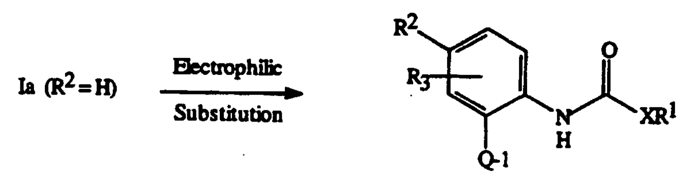
wherein

X^3 is as previously defined in Scheme 5.

Compounds of Formula 8 are well known in the art (see for example, H. Gunter, et al., *Liebigs Ann. Chem.* (1987), 765-770) or may be made by simple functional group interconversions on *ortho*-substituted anilines or a derivative thereof.

In some instances, it may be necessary, or more convenient, to introduce the desired substituents after the coupling reaction was performed. This can be accomplished by electrophilic substitution (Scheme 7), or nucleophilic substitution and functional group modifications (Schemes 8 and 9) using procedures well documented in the literature.

SCHEME 7

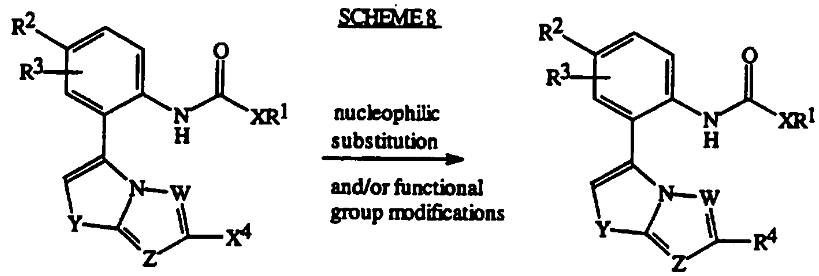


Ia (R^2 = Br, NO_2)

Variation of the substituent R^4 on the heterocycle Q-1 of compounds of Formula Ia may be achieved by one of three ways. First, one skilled in the art may simply select the appropriate heteroaromatic compound of Formula 2a,b for the palladium coupling in Schemes 1 and 4 to give examples with a variety of values for R^4. Alternatively, it may at times be convenient to vary R^4 by performing various functional group transformations on compounds of Formula 9, which can be prepared by the same methods for the preparation of the aryl-substituted heterocycles of Formula Ia, as shown in Scheme 8. Alternatively, it may at times be convenient to vary R^4 by performing various functional group transformations on compounds of Formula 10, which can be prepared by the same methods for the preparation of the *ortho*-substituted nitrophenyl compounds of Formula 7, and then converting the product to compounds of Formula Ia (using methods discussed previously) as shown in Scheme 9. Methods to perform these transformations are well known in the literature. Some examples include conversion of chloro to bromo (L. J. Street, et al., *J. Med. Chem.* (1992), *35*, 295-304), bromo to trifluoromethyl (J. Wrobel, et al., *J. Med. Chem.* (1989), *32*(11), 2493-2500), cyano (Ellis, G. P., T. M. Romney-Alexander, *Chem. Rev.* (1987), *87*, 779-794), aldehyde to

difluoromethyl (Middleton, W. J., *J. Org. Chem.* (1975), *40*, 574-578), thiol to trifluoromethylthio (Popov, V. I., Boiko, V. N., Yagupolskii, L. M., *J. Fluor. Chem.* (1982), *21*, 365-369) and amino to a variety of substituents via the diazonium salts. Electrophilic aromatic substitution or metallation chemistry are also useful methods for incorporating certain substituents.

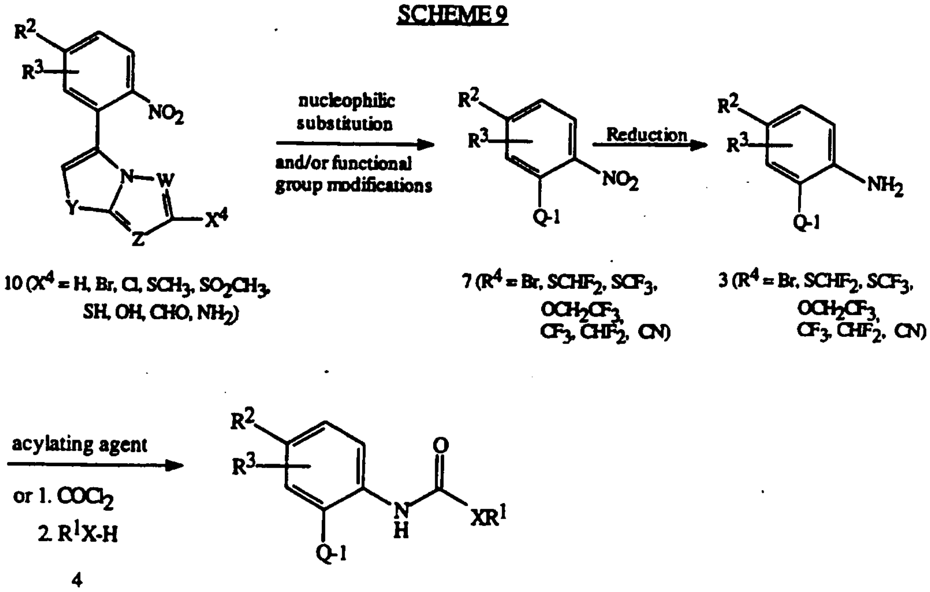
SCHEME 8



9 (X^4 = H, Br, Cl, SCH_3, SO_2CH_3, SH, OH, CHO, NH_2)

Ia (R^4 = Br, $SCHF_2$, SCF_3, OCH_2CF_3, CF_3, CHF_2, CN)

SCHEME 9



10 (X^4 = H, Br, Cl, SCH_3, SO_2CH_3, SH, OH, CHO, NH_2)

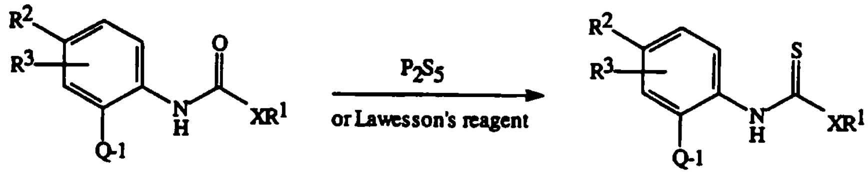
7 (R^4 = Br, $SCHF_2$, SCF_3, OCH_2CF_3, CF_3, CHF_2, CN)

3 (R^4 = Br, $SCHF_2$, SCF_3, OCH_2CF_3, CF_3, CHF_2, CN)

Ia (R^4 = Br, $SCHF_2$, SCF_3, OCH_2CF_3 CF_3, CHF_2, CN)

As shown in Scheme 10, compounds of Formula Ia where T = S can be prepared by one skilled in the art from compounds of Formula Ia where T = O by treatment with P_2S_5 or Lawesson's reagent under conditions well known in the literature, for example: T. P. Sychera, et al., *J. Gen. Chem. U.S.S.R.* (1962), *32*, 2839; K. Yoshino, et al., *J. Heterocycl. Chem.* (1989), *26*, 1039-1043; E. C. Taylor Jr., et al., *J. Amer. Chem. Soc.* (1953), *75*, 1904; and O. P. Goel, et al., *Synthesis-Stuttgart* (1987), *2*, 162-164.

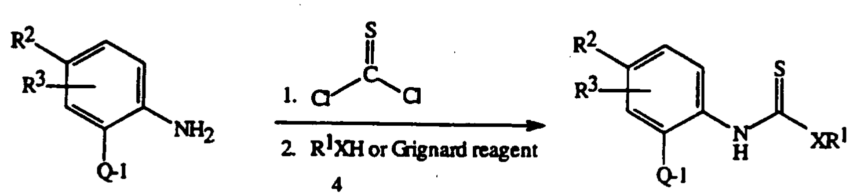
SCHEME 10



Ia (T = O) Ia (T = S)

Alternatively, anilines of Formula 3 can be converted into the corresponding isothiocyanate by treatment with thiophosgene or known thiophosgene equivalents (e.g., 1,1'-thiocarbonyldiimidazole) and then condensed with an appropriate alcohol or amine of Formula 4 or a Grignard-reagent to afford compounds of Formula Ia where T = S (Scheme 11). These techniques are well known in the literature. For example, see Y. M. Zhang, et al., *Tetrahedron Lett.* (1987), *28*, 3815-3816; Ares, J. J., *Synthetic Commun.* (1991), *21*, 625-623; S. Roy, et al., *Indian. J. Chem. B* (1994), *33*, 291-292; J. Garin, et al., *J. Heterocycl. Chem.* (1991), *28*, 359-363; and I. Sircar, et al., *J. Med. Chem.* (1985), *28*, 1405.

SCHEME 11

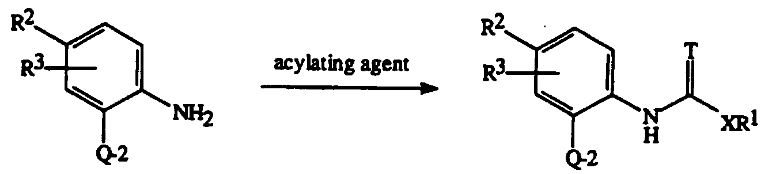


3 Ia (T = S)

As shown in Scheme 12, compounds of Formula Ib can be prepared by one skilled in the art from anilines of Formula 11 by treatment with an appropriate acyl chloride or acid anhydride (T = O, X = direct bond), chloroformate (T = O, X = O),

chlorothiolformates (T = O, X = S), carbamoyl chloride (T = O, X = NR^5), isothiocyanate (T = S, X = NH) isocyanate (T = O, X = NH), or xanthyl chlorides (T = S, X = S) as described for Scheme 2.

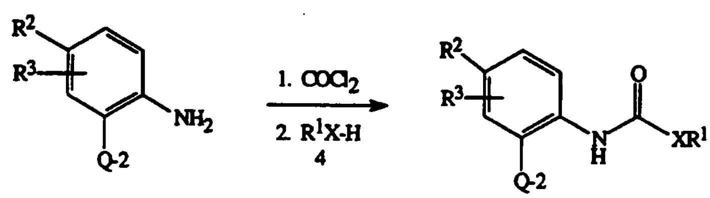
SCHEME 12



11 Ib

Alternatively, anilines of Formula 11 can be converted into the corresponding isocyanate and then condensed with an appropriate alcohol or amine to afford anilides of Formula Ib (Scheme 13). These techniques were described for Scheme 3.

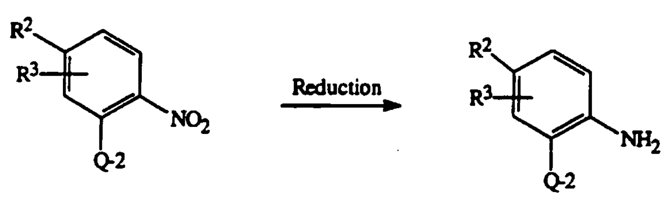
SCHEME 13



11 Ib (T = O)

Anilines of Formula 11 can be prepared by the reduction of compounds of Formula 12 by methods well documented in the literature (Scheme 14). See for example, Ohme, R. and Zubek, A. R. and Zubek, A. in *Preparative Organic Chemistry*, 557; Hilgetag, G. and Martini, A. Eds., John Wiley & Sons, New York: (1972).

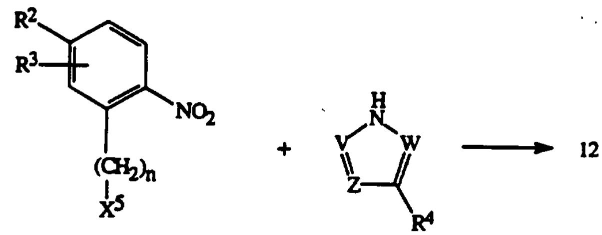
SCHEME 14



12 11

Many compounds of Formula 12 can be prepared by the introduction of the Q-2 substituent by displacement of an appropriate leaving group (X^5) by the appropriate heterocycle of Formula 14 (Scheme 15).

SCHEME 15

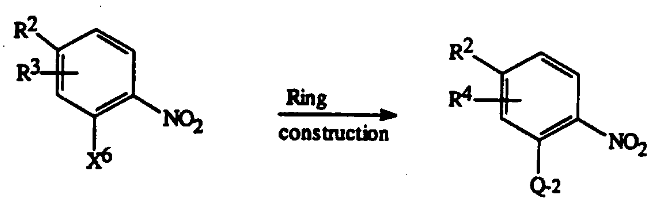


13 14

X^5 = Cl, Br, I, OTf

In other cases, it is advantageous to prepare compounds of Formulae Ib, 11, or 12 by elaboration of an appropriate substituent, X^6 ortho to the amido, amino or nitro group, respectively. This strategy is illustrated in Scheme 16 for the preparation of compounds of Formula 12.

SCHEME 16



15 12

wherein X^6 can be any number of substituents useful in the synthesis of nitrogen heterocycles, including, but not limited to those shown below:

X^3 = NO_2, NH_2, $NHNH_2$, X^5, CH_2X^5, CHO, CO_2H, COCl, CN; and

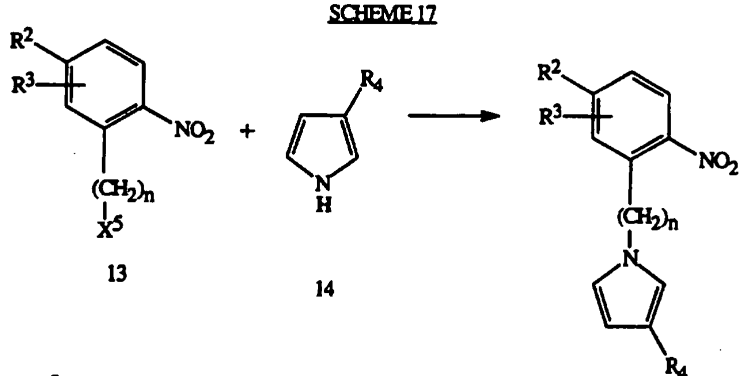
X^5 = Cl, Br, I, OTf.

Compounds of Formula 15 are well known in the art or may be made by simple functional group interconversions on *ortho*-substituted nitrobenzenes.

Some of the numerous methods for conversion of these X^6 substituents into the 5-membered nitrogen heterocycles of Q-2 shown in Scheme 16 and the direct displacement reactions of Scheme 15 are illustrated below.

Scheme 17 shows a direct displacement reaction with an appropriately substituted pyrrole of Formula 14. For example, see: Katritzky, A. R. and Rees, C. E., Eds., *Comprehensive Heterocyclic Chemistry*, Vol. 4, p. 235 ff., Pergamon Press, London (1984); Smith, L. R., *Chem. Heterocycl. Compd.* (1972), *25-2*, 127; Santaniello, E., Farachi, C., Ponti, F., *Synthesis* (1979), 617; Jones, R. A. and Bean, G. P., *The Chemistry of Pyrroles*, Academic Press, London, 1977, Chapter 4, pp. 205-11; Rubottom, G. M. and Chabala, J. C., *Org. Synth.* (1974), *54*, 60.

SCHEME 17

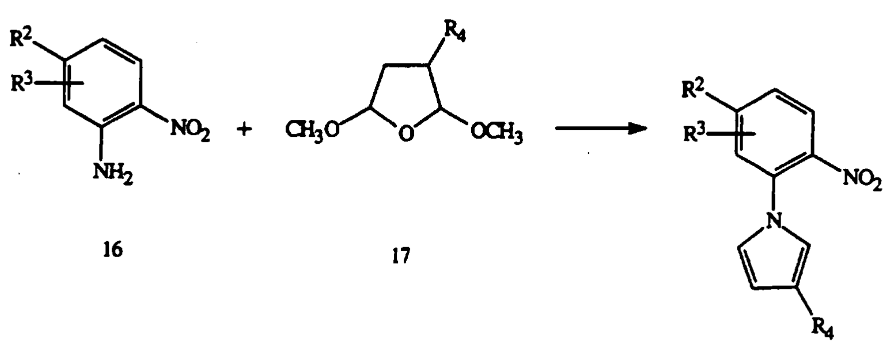


13 14 15

X^5 = Cl, Br, I, OTf

The synthesis of the pyrrole ring system by ring construction is illustrated in Scheme 18 by one of the best procedures. This procedure and others are extensively reviewed in the literature: Katritzky, A. R. and Rees, C. E., Eds., Vol. 4, pp. 313-352, derivatives, pp 353-368, Pergamon, (1984); Kiedy, J. S., Huang, S., *J. Heterocycl. Chem.* (1987), *24*, 1137; Hamdan, A., Wasley, J. W. F., *Synth. Commun.* (1983), *13*, 741; Josey, A. D., *Org. Synth. Coll. Vol. V* (1973), 716.

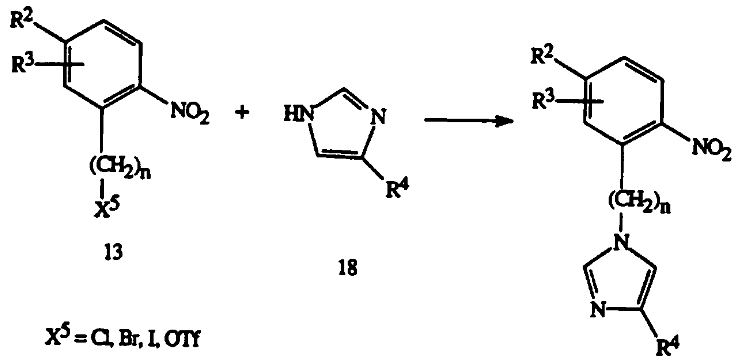
SCHEME 18



16 17 15 (n = 0)

Scheme 19 shows an alkylation reaction of an imidazole by compounds of Formula 13.

SCHEME 19



13

18

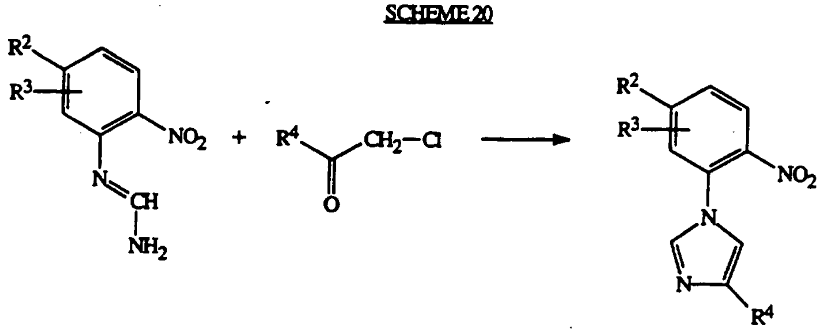
19

X^5 = Cl, Br, I, OTf

The reactions of Scheme 19 can be run by the methods of Ginda, W. C. and Mathre, D. J., *J. Org. Chem.* (1980), *45*, 3172; Mathias, L. R. and Burkett, D., *Tetrahedron Lett.* (1979), 4709; Dorr, H. J. M. and Metzger, J., *Bull. Soc. Chim. Fr.* (1976), 1861; A. F. Pozharskii, et al., *Zh. Obshch. Khim* (1963), *33*, 1005; (1964), *34*, 1371; (*Chem. Abstr. 59*: 7515; *61*: 1849; *65*: 88955; *65*: 13684).

The preparation of imidazole compounds of Formula 19 (wherein n = 0) by ring construction methods are well known in the literature. An illustrative example is shown in Scheme 20.

SCHEME 20



20

21

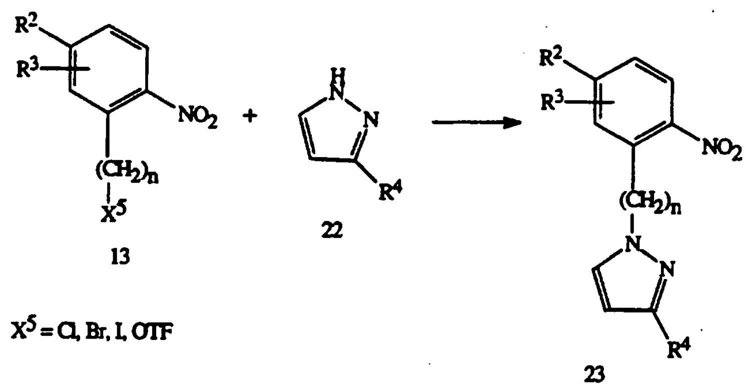
19 (n = 0)

The method of Scheme 20 and many others are taught and reviewed in Katritzky, A. R. and Boulton, A. J., *Advances in Heterocyclic Chemistry*, Vol. 12,

pp 166-183, Academic, New York, 1970; Bacon, R. G. R. and Hamilton, S. D., *J. Chem. Soc. Perkin Trans. I* (1974), 1970, and Katritzky, A. R. and Rees, C. E., *Comprehensive Heterocyclic Chemistry* Vol. 5, pp 457-482, Pergamon, London, 1984.

Pyrazole compounds of Formula 23 can be prepared by direct displacement reactions as shown in Scheme 21.

SCHEME 21



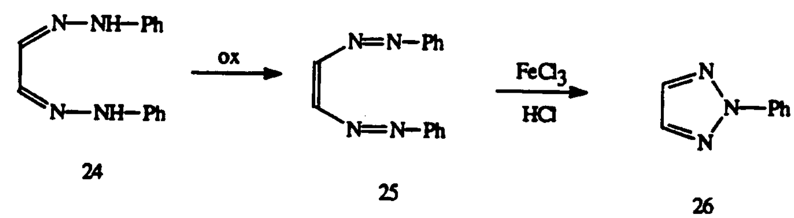
X^5 = Cl, Br, I, OTf

N-alkylation and *N*-arylation are taught by Dorr, H. J. M., Elguero, J., Espada, M. and Hassanaly, P., *An Quim.* (1978), *74*, 1137; Khan, M. A. and Lynch, B. M., *J. Heterocycl. Chem.* (1970), *7*, 1237; Elguero, J., Espada, M., Mathier, D. and Lun, R. P. T., *An Quim*, (1979), *75*, 729; Guida, W. C. and Mathre, D. J., *J. Org. Chem.* (1980), *45*, 3172; J. Elguero, et al., *Bull. Chem. Soc. Fr.* (1970), 1121; (1968), 707, 5019; (1967), 1966, 619, 775, 2833, 3727; Khan, M. A., *Rec. Chem. Prog.* (1970), *31*, 43.

A synthesis of an *N*-aryl pyrazole by a ring construction method is illustrated in Example 3. Numerous other methods are reviewed in Katritzky, A. R. and Rees, C. E., *Comprehensive Heterocyclic Chemistry*, Vol. 5, p 272 ff.

The preparations of the 2-substituted-1,2,3-triazoles of this invention are reviewed by Katritzky, A. R. and Rees, C. E., *Comprehensive Heterocyclic Chemistry*, Vol. 5, p 690 ff., Pergamon, London, 1984; and Elderfield, R. E., Ed. *Heterocyclic Compounds*, Vol. 7, p 384, John Wiley & Sons, New York, 1961. One of the various syntheses is illustrated in Scheme 22.

SCHEME 22

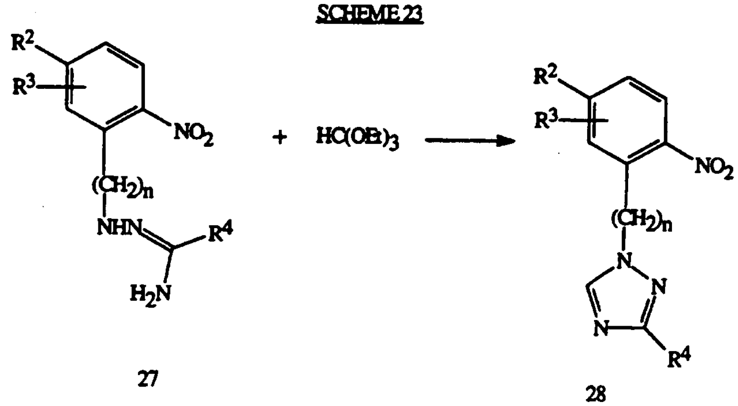


This procedure and others are taught by Coles, R. F. and Hamilton, C. F., *J. Am. Chem. Soc.* (1946), *68*, 1179; Riebsomer, J. L., *J. Org. Chem.* (1948), *13*, 815; Stolle, R., *Ber.* (1926), *59*, 1742; Finley, K. T., *Chem. Heterocycl. Compd.* (1980), *39*, 1; Carboni, R. A., Kauer, J. C., Hatcher, W. R., Harder, R. J., *J. Amer. Chem. Soc.* (1967), *89*, 2626.

The preparation of the 1-substituted -1,2,4-triazoles of Formula 28 by direct displacement reactions on compounds of Formula 13 are reviewed and taught in Schofield, K., Grimmett, M. R. and Keene, B. R., *Heteroaromatic Nitrogen Compounds: The Azoles*, pp 735-757, Cambridge University, Cambridge, 1976; Potts, K. T., *Chem. Rev.* (1961), *61*, 87; Kahn, M. A. and Polya, J. B., *J. Chem. Soc. (C)* (1970), 85.

Alternatively, the 1,2,4-triazole compounds of Formula 28 can be prepared by ring construction methods well known in the literature. An illustrative example is given in Scheme 23.

SCHEME 23



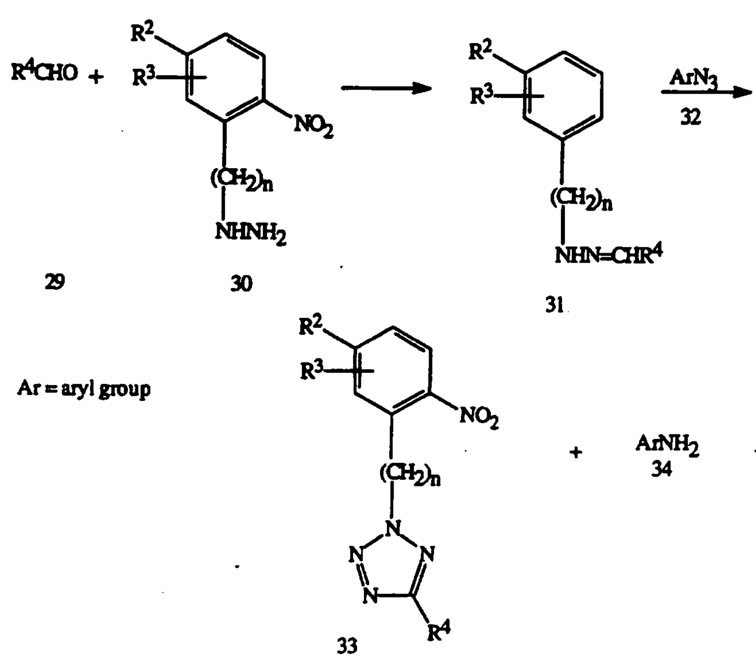
The method of Scheme 23 and many others are taught and reviewed in Katritzky, A. R. and Rees, C. E., *Comprehensive Heterocyclic Chemistry*, Vol. 5, p 762 ff., Pergamon, London, 1984; K. Matsumoto, et al., *Synthesis* (1975), 609;

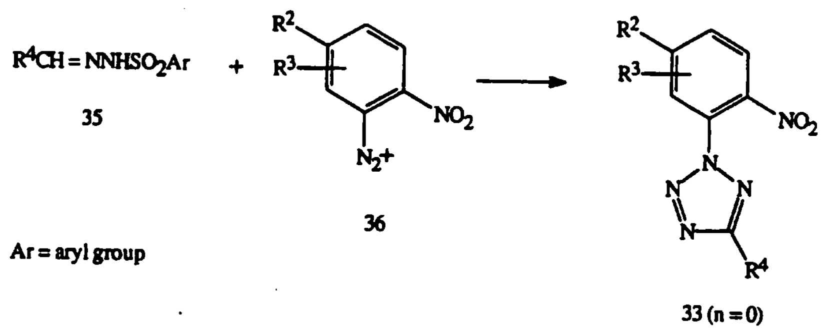
Hüisgen, R., Grashey, R., Aufderhaar, E., Kung, Z., *Chem. Ber.* (1965), *98*, 642, Grundman, C. and Ratz, R., *J. Org. Chem.* (1956), *21*, 1037.

The preparation of the 2-substituted tetrazoles of Formula 33 by direct displacement on a compound of Formula 13 is reviewed and taught by Katritzky, A. R. and Rees, C. E., *Comprehensive Heterocyclic Chemistry*, Vol. 5, p 817 ff.; Pergamon, London, 1984; general alkylation - Butler, R. N., Garvin, V. C., and McEvoy, T. M., *J. Chem. Res.* (*S*) (1981), 174; benzylation - Doderhack, D., *Chem. Ber.* (1975), *108*, 887; with activated aryl halides - Komecke, A., Lepom, P., and Lippmann, E., *Z. Chem.* (1978), *81*, 214.

The preparation of 2-substituted tetrazoles of Formula 33 by ring construction methods are well known in the literature. Illustrative examples are shown in Scheme 24.

SCHEME 24

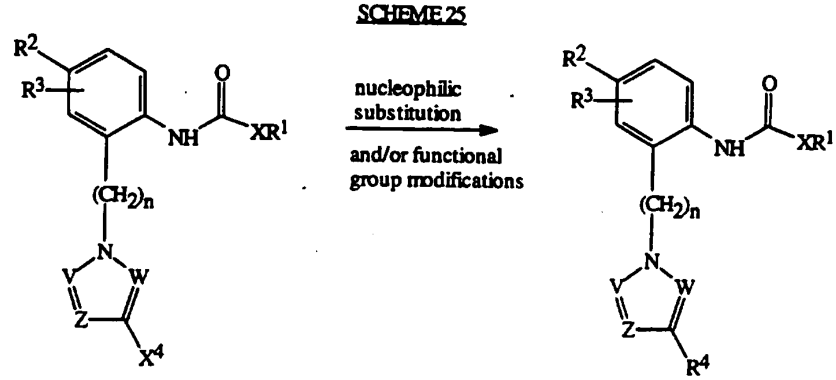




U. Saha, et al., *J. Inst. Chem* (India) (1980), *52*, 196; Baldwin, J. E., *J. Heterocycl. Chem.* (1968), *5*, 565; Hong, S.-Y. and Baldwin, J. E., *Tetrahedron* (1968), *24*, 3787; Ito, S., Tanaka, Y., Kakehi, A. and Kondo, K., *Bull. Chem. Soc. Jpn.* (1976), *49*, 1920.

Variation of the substituent R^4 on the heterocycle Q-2 of compounds of Formula Ib may be achieved by one of two ways. First, one skilled in the art may simply select the appropriate heteroaromatic compound of Formula 14, in Scheme 15 to give examples with a variety of values for R^4. Alternatively, it may at times be convenient to vary R^4 by performing various functional group transformations on compounds of Formula 37, which can be prepared by the same methods for the preparation of the aryl-substituted heterocycles of Formula Ib, as shown in Scheme 25. Methods to perform these transformations are well known in the literature and were described in the discussion for Schemes 8 and 9.

SCHEME 25

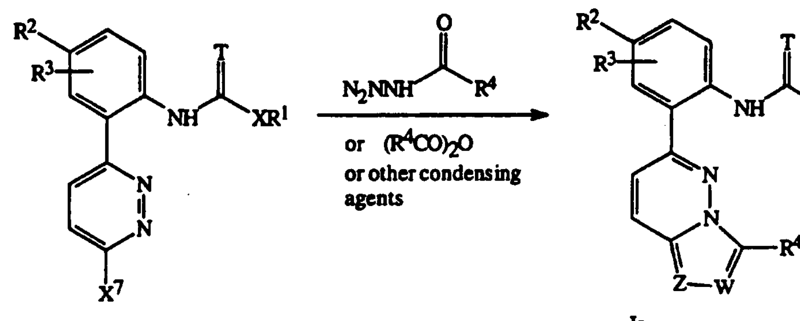


37 (X^4 = H, Br, Cl, SCH_3, SO_2CH_3, SH, OH, CHO, NH_2)

Ib (R^4 = Br, $SCHF_2$, SCF_3, OCH_2CF_3, CF_3, CHF_2, CN)

Scheme 26 illustrates the preparation of compounds of Formula Ic (Formula I where Q is Q-3) whereby an appropriately substituted pyridazine of Formula 38 is reacted with a suitably substituted condensing agent such as hydrazides, anhydrides, orthoesters, β-dicarbonyl compounds and others. Much work has been published with regard to cyclizations of this type. For example see: Katritzky, A. R. and Rees, C. W., *Comprehensive Heterocyclic Chemistry*, Vol. 5, pp 607-668; Vol. 4, 443-495, Pergamon, London (1984); Pollak, A., Stanovnik, V. and Tisler, M., *Tetrahedron* (1968), 2623; L. M. Berbel, M. L. Zamura, *Tetrahedron* (1965), 287; Stanovnik, B., Tisler, M., *Tetrahedron* (1967), 2739; Fraser, M., *J. Org. Chem.* (1971), 3087; F. D. Popp, et al., *J. Heterocyclic Chem.* (1981), 443; Thompson, R. D., Castle, R. N., *J. Heterocyclic Chem.* (1981), 1523-1527; J. D. Albright, et al., *J. Med. Chem.* (1981), 592-600; Legraverend, M., Bisagn, C., Lhoste, J. M., *J. Heterocyclic Chem.* (1981), 893-898; Pollak, A., Tisler, M., *Tetrahedron* (1966), 2073-2079; Letsinger, R. L., Lasco, R., *J. Org. Chem.* (1956), 764; Ohsaua, A., Abe, Y., Igeta, H., *Chem. Lett.* (1979), 241.

SCHEME 26

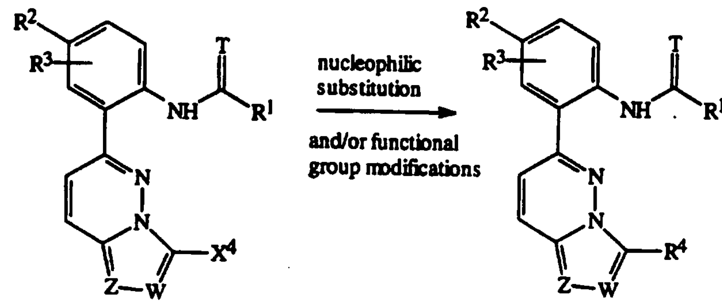


38: X^7 = halogen, NH_2, $NHNH_2$, CH_3, H

Ic

The substituent R^4 may often be incorporated by selection of the proper condensing agent. However, it may at times be necessary or convenient to introduce the desired substituents after the cyclization has occurred. This strategy is shown in Scheme 27. Numerous methods for such transformations are known to those skilled in the art. For example: Stanovnik, B., Tisler, M., *Tetrahedron*, (1967), 387-395; Kobe, J., Stanovnik, B., Tisler, M., *Tetrahedron*, (1968), 239-245, and methods discussed in Schemes 8 and 9. Compounds of Formula 39 can be prepared by the same methods shown in Scheme 26.

SCHEME 27

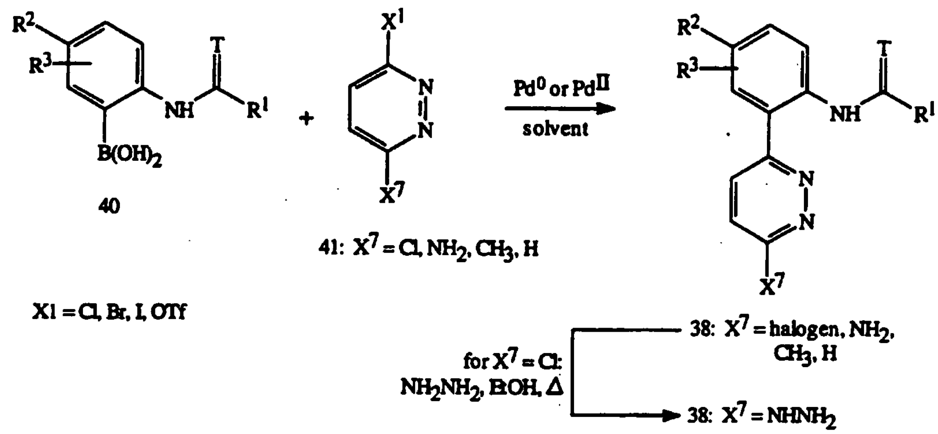


39 (X^4 = H, Br, Cl, SCH_3, SO_2CH_3, SH, OH, CHO, NH_2)

Ic (R^4 = Br, Cl, haloalkylthio, haloalkoxy, haloalkyl, CN, NO_2)

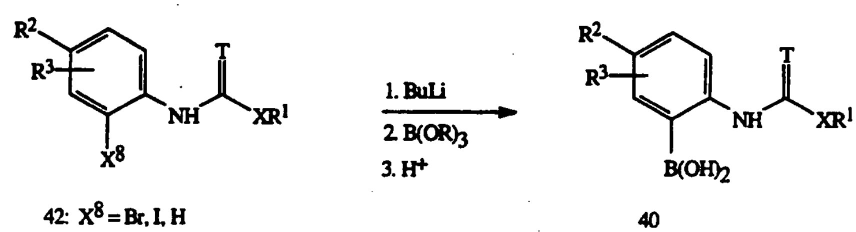
The arylpyridazines of Formula 38 can be prepared by palladium-catalyzed coupling of an arylboronic acid of Formula 40 with a pyridazine of Formula 41 as shown in Scheme 28. The pyridazines of Formula 41 are commercially available or can be prepared by methods known in the art. One skilled in the art will notice that for $X^7 = NHNH_2$, compounds of Formula 38b can be prepared by nucleophilic displacement of chlorine as shown in Scheme 28. The coupling is carried out by methods known in the literature as discussed for Scheme 1. The coupling is carried out by heating the mixture of 40 and 41 in the presence of a transition metal catalyst such as tetrakis(triphenylphosphine)palladium (0) or bis(triphenylphosphine)palladium (II) dichloride in a solvent such as toluene, acetonitrile, glyme or tetrahydrofuran optionally in the presence of bases such as aqueous sodium carbonate or triethylamine. One skilled in the art will recognize that when X^7 is chlorine, the stoichiometric ratios of reagents will need adjustment in order to avoid bis-coupling.

SCHEME 28



The requisite boronic acid can be prepared according to literature cited for Scheme 1 as shown in Scheme 29. This involves treating a bromide or iodide of Formula 42 with a metallating agent such as butyllithium followed by quenching with a trialkyl borate and, finally, treating with dilute acid to give the desired boronic acids of Formula 40. One skilled in the art will further note that when $X^8 = H$, this constitutes an *ortho*-metallation for which there is ample precedent. As an example, see Fuhrer, W., *J. Org. Chem.* (1979), 1138.

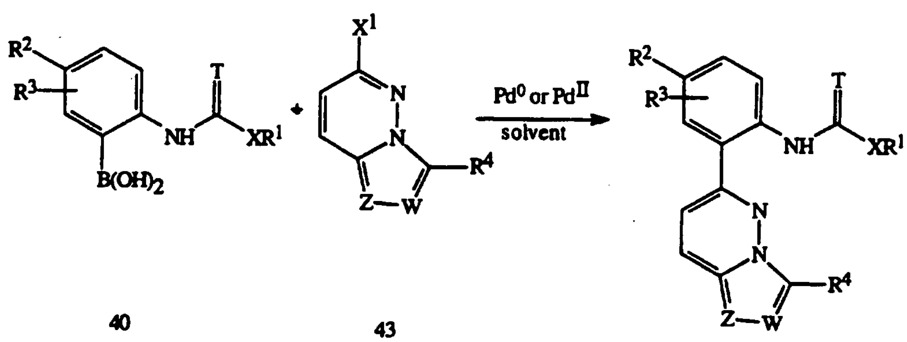
SCHEME 29



The anilides of Formula 42 are either known or readily prepared by procedures and techniques well known in the art, for example: Houben-Weyl, *Methoden der Organische Chemie*, IVth Ed., Eugen Muller, Ed., George Thieme Verlag; I. J. Turchi, *The Chemistry of Heterocyclic Compounds*, Vol. 45, pp 36-43, J. Wiley & Sons, New York, (1986); L. S. Wittenbrook, G. L. Smith, R. J. Timmons, *J. Org. Chem.* (1973), 465-471; P. Reynard, et al., *Bull. Soc. Chim. Fr.* (1962), 1735-1738.

Compounds of Formula Ic can also be prepared by coupling of the boronic acids of Formula 40 with a heterocycle of Formula 43 as depicted in Scheme 30. One skilled in the art will recognize that the heterocycles of Formula 43 can be prepared according to procedures previously referenced for ring annulation as described for Scheme 26. This is also true with respect to the variation of substituent R^4.

SCHEME 30

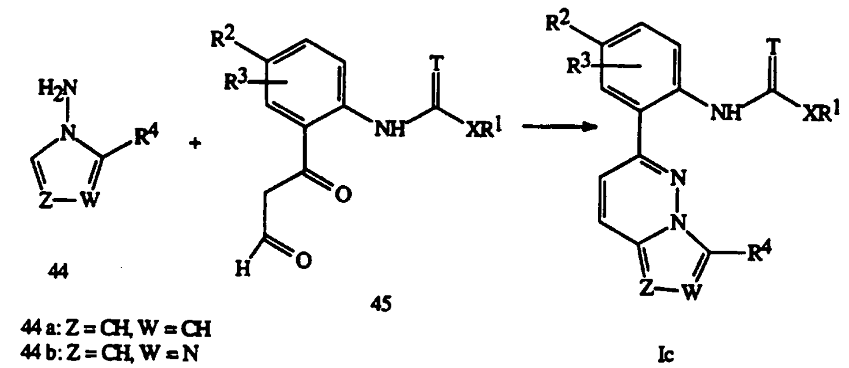


40 43 Ic

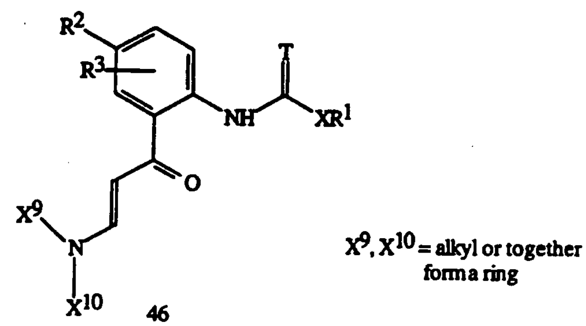
X^1 = Cl, Br, I, OTf

Another method for the preparation of Ic, especially where Z = CH and W = N or CH, is described in Scheme 31. For example, a suitably substituted *N*-aminopyrrole (44a) or *N*-aminoimidazole (44b) can be condensed with a β-dicarbonyl compound of Formula 45 to give the desired products. Several methods for this transformation are known in the art. For example, see Flitsch, W.; Krämer, V. *Liebigs Ann. Chem.* (1970) *735*, 35; Blewith, H. L., *Chem. Heterocyclic Compd.* (1977) *30*, 117; Maury, G., *Chem. Heterocyclic Compd.* (1977) *30*, 179; Coppola, G. M.; Hardtmann, G. E.; Huegi, B. S. *J; Heterocyclic Chem.* (1974) *11*, 51; Golubusuma, G. M.; Posntarck, G. N.; Chuguk, V. A. *Khim. Geterotsikl. Soedin.* (1974) 846; Brückner, R.; Lavergne J.- P.; Vailfont, P., *Liebigs Ann. Chem.* (1979), 639; A. A. Tomaswin, et al., *Ukr. Khim.* (1988), *54*, 612.

SCHEME 31



Numerous methods for the preparation of the required *N*-aminoheterocycles of Formula 44a and 44b and β-dicarbonyl compounds (45) or their equivalents (for example, compounds of Formula 46) are well known in the literature. For example, see:

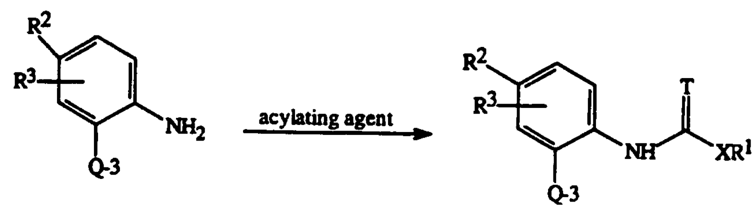


Stetter, H., Jones, F., *Chem. Ber.* (1981), 564; M. Somei, et al., *Chem. Pharm, Bull.* (1978), 2522; Somei, M., Natsume, M., *Tetrahedron Lett.* (1974), 461; Schweitzer, E. L., Kopey, C. M., *J. Org. Chem.* (1972), 1561; Perveev, F. Y., Ershova, V., *Zh. Org. Khim.* (1961), 3554; Sitte, A., Paul, H., Hilgetag, G., *Z. Chem.* (1967), 341; R. N. Neylor, et al., *J. Chem. Soc.* (1961), 4845; Frohlisch, B., *Chem. Ber.* (1971), 3610; Sherif, J. E., Rene, L., *Synthesis* (1988), 138; J. T. Gupton, et al., *J. Org. Chem.* (1980), 4522; Tsuge, O., Limune, T., Horie, M., *Heterocycles* (1976), 13; Kreutzenberger, A., Kreutzenberger, E., *Tetrahedron* (1976), 2603.

Compounds of Formula Ic can also be prepared by one skilled in the art from anilines of Formula 47 by treatment with an appropriate acyl halide or acid anhydride (T = O, X = direct bond), chloroformates (T = O, X = O), chlorothiolformates (T = O,

X = S), carbamoyl chlorides (T = O, X = NR^5), isothiocyanates, (T = S, X = NH), isocyanates (T = O, X = NH) or xanthyl chlorides (T = S, X = S). Treatment of compounds such as amides (X = bond, T = O) with Lawesson's reagent will give thioamides (X = bond, T = S). This is illustrated in Scheme 32 and is well known to those skilled in the art. For example: Sandler, R. S., Karo, W., *Organic Functional Group Preparations*, 2nd Ed., Vol. 1, p 274 and Vol. 2, pp 152, 260, Academic.

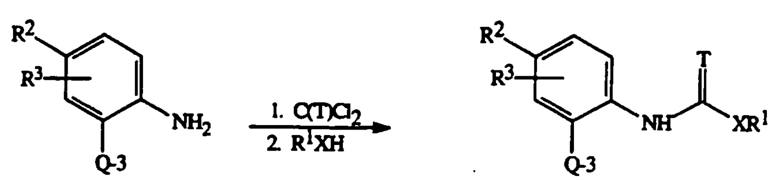
SCHEME 32



47 Ic

Alternatively, compounds of Formula 47 can be converted to compounds of Formula Ic by first treating the anilines with thiophosgene or phosgene (or a phosgene equivalent such as triphosgene) followed by condensation with an appropriate alcohol, thiol, or amine, as shown in Scheme 33. These techniques are also well known in the literature. For example, see Sandler, R. S., Karo, W., *Organic Functional Group Preparation*, 2nd Ed., Vol. 2, pp 152, 260, Academic; Lehman, G., Teichman, H., *Preparative Organic Chemistry*, p 472, John Wiley & Sons, New York, (1972); Eckert, H., Forster, B., *Angew, Chem. Int. Ed. Eng.* (1987), 894; Babed, H., Zeiler, A. G., *Chem. Rev.* (1973), 75.

SCHEME 33

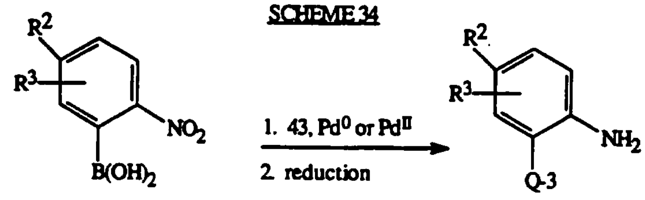


47 Ic

Anilines of Formula 47 are readily prepared by palladium-catalyzed coupling of an *ortho*-substituted nitrophenyl compound of Formula 48 with a heterocycle of Formula 43 (described previously), followed by catalytic hydrogenation or chemical reduction of the

nitro group as shown in Scheme 34. Reduction of nitro groups is well documented in the literature. See for example, Ohme, R., Zubek, A. R. in *Preparative Organic Chemistry*, 557, Hilgetag, G. and Martini, A., Eds. John Wiley & Sons, New York (1972).

SCHEME 34



48 47

It is recognized that some reagents and reaction conditions described above for preparing compounds of Formula I may not be compatible with certain functionalities present in the intermediates. In these instances, the incorporation of protection/deprotection sequences or functional group interconversions into the synthesis will aid in obtaining the desired products. The use and choice of the protecting groups will be apparent to one skilled in chemical synthesis (see, for example, Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991). One skilled in the art will recognize that, in some cases, after the introduction of a given reagent as it is depicted in any individual scheme, it may be necessary to perform additional routine synthetic steps not described in detail to complete the synthesis of compounds of Formula I. One skilled in the art will also recognize that it may be necessary to perform a combination of the steps illustrated in the above schemes in an order other than that implied by the particular sequence presented to prepare the compounds of Formula I.

One skilled in the art will also recognize that compounds of Formula I and the intermediates described herein can be subjected to various electrophilic, nucleophilic, radical, organometallic, oxidation, and reduction reactions to add substituents or modify existing substituents.

Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present invention to its fullest extent. The following Examples are, therefore, to be construed as merely illustrative, and not limiting of the disclosure in any way whatsoever. Percentages are by weight except for chromatographic solvent mixtures or where otherwise indicated. Parts and percentages for chromatographic solvent mixtures are by volume unless otherwise indicated.

^{1}H NMR spectra are reported in ppm downfield from tetramethylsilane; s = singlet, d = doublet, t = triplet, p = pentet, m = multiplet, br s = broad singlet.

EXAMPLE 1

Step A: Preparation of 1-(2-amino-5-methylphenyl)-2-[[5-(trifluoromethyl)-4*H*-1,2,4-triazol-3-yl]thio]ethanone

0.33 g (0.0144 mol) of sodium was dissolved under nitrogen in 50 mL of methanol, 2.55 g (0.0151 mol) of 5-(trifluoromethyl)-4*H*-1,2,4-triazole-3(2*H*)-thione hydrate (purchased from Lancaster) was added, and the mixture was stirred at room temperature for 1 h, after which 2.52 g (0.0137 mol) of 1-(2-amino-5-methylphenyl)-2-chloroethanone was added. After stirring overnight, the reaction mixture was evaporated to dryness. The crude product was washed with water and purified by recrystallization from chloroform to yield 2.40 g of the title compound of Step A as a powder melting at 205°C (dec.). ^{1}H NMR (Me_2SO-d_6): δ 2.20 (s,3H), 4.98 (s,2H), 6.71-7.61 (m,4H).

Step B: Preparation of 4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]benzenamine

1.30 g (0.0041 mol) of the title compound of Step A was dissolved under nitrogen in 5 mL of concentrated sulfuric acid. The reaction mixture was stirred at about 100°C for 2 h. After cooling to about 0°C, 1N sodium hydroxide was added slowly until the reaction mixture reached pH 7. The crude product was filtered and washed with hexane to yield 1.0 g of the title compound of Step B as a powder melting at 132-133°C. ^{1}H NMR ($CDCl_3$): δ 2.31 (s,3H), 6.78-7.29 (m,4H).

Step C: Preparation of 3-methyl-*N*-[4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]phenyl]butanamide

0.50 g (0.0017 mol) of the title compound of Step B was added to 50 mL of diethyl ether, and the suspension was cooled under nitrogen to about 0°C. 0.25 mL (0.0020 mol) of isovaleryl chloride was added, followed by 0.30 mL (0.0022 mol) of triethylamine, and the mixture was stirred at room temperature for about 4 h. The reaction mixture was filtered and the filtrate was evaporated to dryness. Water was added and the mixture was extracted with diethyl ether (3 x 25 mL), dried ($MgSO_4$), and evaporated to dryness. The crude product was chromatographed on silica gel eluting with ethyl acetate/hexane (2:8, and then 3:7) mixture to yield 0.04 g of the title compound of Step C, a compound of the invention, as a powder melting at 177-178°C. ^{1}H NMR (Me_2SO-d_6): δ 0.79 (d,6H), 1.9 (m,1H), 1.97 (d,2H), 2.34 (s,3H), 7.3-7.7 (m,4H), 9.3 (s,1H).

EXAMPLE 2

Step A: Preparation of 1-[(5-methyl-2-nitrophenyl)methyl]-3-(trifluoromethyl)-1*H*-pyrazole

5.65 g (0.030 mol) of 5-methyl-2-nitrobenzyl chloride (purchased from Aldrich Chemical Company), 5.0 g (0.036 mol) of 3-(trifluoromethyl)pyrazole (purchased from Maybridge), and 12.4 g (0.090 mol) of potassium carbonate were added to 25 mL acetonitrile. The reaction mixture was stirred under nitrogen overnight, and then was evaporated to dryness. The crude product was purified by recrystallization from methanol. The solid was washed with water, dissolved in ethyl acetate, dried ($MgSO_4$), and evaporated to dryness to yield 6.26 g of the title compound of Step A as a powder. Water was added to the mother liquor to yield after filtration an additional 1.2 g of the title compound of Step A as a solid melting at 70-71.5°C. ^1H NMR ($CDCl_3$): δ 2.38 (s,3H), 5.76 (s,2H), 6.60-8.07 (m,5H).

Step B: Preparation of 4-methyl-2-[[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]methyl]benzenamine

3.2 g (0.011 mol) of the title compound of Step A was added to a solution of 15 mL acetic acid and 6 mL water. The mixture was warmed to about 65°C, the heat was shut off, and 2.1 g (0.037 mol) of iron was added in portions maintaining the temperature below 91°C. The mixture was warmed to about 75°C for 15 min., gravity filtered onto about 100 g of ice, and then extracted with methylene chloride (3 x 50 mL). The organic extracts were washed with saturated aqueous sodium bicarbonate, dried ($MgSO_4$), and evaporated to dryness to yield 1.8 g of the title compound of Step B as an oil. ^1H NMR ($CDCl_3$): δ 2.25 (s,3H), 5.0 (br s,2H), 5.22 (s,2H), 6.49-7.40 (m,5H).

Step C: Preparation of 2-methyl-*N*-[4-methyl-2-[[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]methyl]phenyl]propanamide

0.55 g (0.0022 mol) of the title compound of Step B was dissolved under nitrogen in 50 mL of diethyl ether. The solution was cooled to about 0°C, 0.27 mL (0.0026 mol) of isobutyryl chloride was added followed by 0.39 mL (0.0028 mol) of triethylamine. The reaction mixture was stirred over 3 days and was then filtered. The filtrate was evaporated to dryness, the resulting residue was suspended in water, and the crude product was then filtered and washed with hexane to yield 0.36 g of the title compound of Step C, a compound of the invention, as a powder melting at 125-125.5°C. ^1H NMR ($CDCl_3$): δ 1.31 (d,6H), 2.32 (s,3H), 2.7 (m,1H), 5.21 (s,2H), 6.52-7.8 (m,5H), 9.3 (br s,1H).

EXAMPLE 3

Step A: Preparation of (5-methyl-2-nitrophenyl)hydrazine

1-Fluoro-5-methyl-2-nitrobenzene (Aldrich, 20 g, 129 mmol) was treated with hydrazine hydrate (7.0 g, 140 mmol) in DMF (100 mL) at 25°C for 3 h. The mixture was drowned in water (1000 mL) and the precipitated product filtered. The filtrate was extracted with ethyl acetate and the combined product purified by flash chromatography to give 8.38 g of the title compound of Step A as a solid melting at 128-130°C. IR (mineral oil) 3320, 3330 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 2.38 (s,3H), 3.75 (s,2H), 6.5 (d,1H), 7.38 (s,1H), 8.0 (d,1H), 8.9 (br s,1H).

Step B: Preparation of 2,2,2-trifluoroethanone (5-methyl-2-nitrophenyl)hydrazone

The title compound of Step A (3.0 g, 18 mmol) in dioxane (30 mL) was heated at reflux with trifluoroacetaldehyde hydrate (3.0 g, 26 mmol) and a catalytic amount of *p*-toluenesulfonic acid (0.1 g) for 20 h. The product was isolated by evaporation of the solvent and recrystallization from methanol/water to give 3.87 g of the title compound of Step B as a solid melting at 159-160°C. IR (mineral oil) 3368, 1612 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 2.44 (s,3H), 6.8 (d,1H), 7.25 (s,1H), 7.65 (s,1H), 8.1 (d,1H), 11.15 (br s,1H).

Step C: Preparation of 2,2,2-trifluoro-*N*-(5-methyl-2-nitrophenyl)ethanehydrazonoyl bromide

A DMF solution (35 mL) of the title compound of Step B (3.8 g, 15.4 mmol) was treated with *N*-bromosuccinimide (2.9 g, 16.3 mmol) at 25°C for 3 h. The reaction mixture was drowned in water (250 mL) and extracted with ethyl acetate. The product, isolated by evaporation of the solvent, was slurried with hexane and purified to give 4.2 g of the title compound of Step C as a solid melting at 135-139°C. IR (mineral oil) 3264, 1618 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 2.46 (s,3H), 6.9 (d,1H), 7.6 (s,1H), 8.15 (d,1H), 11.3 (s,1H).

Step D: Preparation of 5-butoxy-4,5-dihydro-1-(5-methyl-2-nitrophenyl)-1*H*-pyrazole

A benzene (75 mL) and toluene (30 mL) solution of the title compound of Step C (4.0 g, 12.25 mmol), butyl vinyl ether (6.5 g, 6.5 mmol), and triethylamine (1.3 g, 13 mmol) was heated at 90°C for 12 h. Isolation by flash chromatography (1-chlorobutane) gave 2.3 g of the title compound of Step D as an oil. ^1H NMR (300 MHz, $CDCl_3$): δ 0.76 (t,3H), 1.05 (p,2H), 1.3 (p,2H), 2.43 (s,3H), 3.0-3.25 (m,4H), 5.8 (d,1H), 7.05 (d,1H), 7.4 (s,1H), 7.8 (d,1H).

Step E: Preparation of 1-(5-methyl-2-nitrophenyl)-3-(trifluoromethyl)-1*H*-pyrazole

An ethyl acetate solution (25 mL) of the title compound of Step D (2.3 g, 6.7 mmol) was treated with a catalytic amount of *p*-toluenesulfonic acid (<0.1 g) at 25°C for 1 h. Flash chromatography gave 1.69 g of the title compound of Step E as a crystalline solid melting at 84-86°C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 2.52 (s,3H), 6.7 (d,1H), 7.4 (m,2H), 7.7 (s,1H), 7.95 (d,1H).

Alternatively, the title compound of Step E can be prepared directly from 1-fluoro-5-methyl-2-nitrobenzene. A solution of 1-fluoro-5-methyl-2-nitrobenzene (6.04 g, 39 mmol) and 3-(trifluoromethyl)pyrazole (5.05 g, 37.1 mmol) and potassium carbonate (5.63 g, 40.8 mmol) was heated in dimethyl sulfoxide (30 mL) at 50 °C for 18 h. The cooled mixture was diluted with water (100 mL) and extracted with ethyl acetate (3 x 50 mL). The combined organic layers were washed with water (2 x 50 mL) and saturated aqueous NaCl (2 x 50 mL). The organic layer was dried over magnesium sulfate and evaporated. The resulting yellow solid was triturated with hexane to give 9.5 g of the title compound of Step E melting at 84-86 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 2.52 (s,3H), 6.75 (s,1H), 7.4 (m,2H), 7.72 (s,1H), 7.95 (d,1H).

Step F: Preparation of 4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzenamine

An ethanol solution (250 mL) of the title compound of Step E (1.65 g, 6.1 mmol) and palladium catalyst (10% Pd/C, 0.5 g) was pressurized to 3.45×10^5 Pa with hydrogen in a Paar hydrogenation apparatus at 25°C for 5 h. The reaction mixture was filtered through Celite® and the solvent was evaporated to give, after crystallization from 1-chlorobutane, 0.77 g of the title compound of Step F as a solid melting at 66-68°C. IR (mineral oil) 3469, 3365 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 2.28 (s,3H), 4.36 (br s,2H), 6.7 (d,1H), 6.76 (d,1H), 7.02 (d,2H), 7.75 (s,1H).

Step G: Preparation of 2-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]propanamide

To a benzene solution (30 mL) at 25°C was added the title compound of Step F (0.75 g, 3.14 mmol), pyridine (0.5 g, 6.3 mmol), and isobutyryl chloride (2.0 g, 19 mmol). The mixture was stirred at 25°C for 18 h. Water (100 mL) was added to the mixture and the products were extracted by the addition of ethyl acetate. The product was a mixture of the mono- and bis-acylated aniline. A brief treatment of the mixture with dilute sodium hydroxide in methanol and reisolation by drowning in water and ethyl acetate extraction gave 0.58 g of the title compound of Step G, a compound of the

invention, as a solid melting at 99-100°C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 1.2 (d,6H), 2.38 (s,3H), 2.5 (p,1H), 6.8 (s,1H), 7.2 (s,1H), 7.3 (m,1H), 7.8 (s,1H), 8.3 (d,1H).

EXAMPLE 4

Step A: Preparation of *N*-(2-borono-4-methylphenyl)-2,2-dimethylpropanamide

A solution of 72.4 g *N*-(4-methylphenyl)-2,2-dimethylpropanamide in 1000 mL of dry THF was cooled to -70°C under nitrogen and 480 mL of 2.5M *n*-BuLi in hexanes was added dropwise over 1 h while maintaining the temperature below -60°C. Stirring was continued at -70°C for 1 h, and then the reaction was allowed to warm to room temperature with stirring overnight.

The reaction mixture was then cooled to -10°C and 200 mL of trimethyl borate was added dropwise while maintaining the temperature below 0°C. Stirring was continued at 0°C for 2.5 h, 50 mL of water was added dropwise over 0.5 h, and then concentrated HCl was added to acidify the reaction. The solvents were removed *in vacuo*, 200 mL of water was added to form a slurry which was shaken (or stirred) thoroughly with ether. The white precipitate was collected by filtration, washed well with a 1:1 ether/hexane mixture, and then suspended in acetone and stirred for 20 min. While stirring, 600 mL of water was added slowly in portions (more water may be necessary if precipitation is not complete). The white solid was collected by filtration, washed with water, and then dried in a vacuum oven to yield 56.8 g of the title compound of Step A as a white powder. ^{1}H NMR ($CDCl_3$): δ 1.03 (s,9H), 2.40 (s,3H), 7.20 (d,1H), 7.80 (s,1H), 7.96 (d,1H), 9.8 (s,1H).

Step B: Preparation of *N*-[2-(6-chloro-3-pyridazinyl)-4-methylphenyl]-2,2-dimethylpropanamide

To a stirred mixture of 8.4 g (0.056 mol) of 3,6-dichloropyridazine, 0.3 g of tetrakis(triphenylphosphine)palladium (0), and 6.6 g (0.028 mol) of the title compound of Step A was added 110 mL of a 1 molar aqueous solution of sodium carbonate. The resulting mixture was heated at reflux for 4 h. After cooling to room temperature, the reaction mixture was poured into 200 mL of saturated aqueous NaCl and extracted three times with 50 mL portions of ethyl acetate. The combined extracts were washed once with water and then dried over anhydrous magnesium sulfate. The solution was filtered and evaporated to dryness. The crude product was purified by chromatography on silica gel using 20% ethyl acetate/hexane as eluent to afford 4.42 g (52%) of the title compound of Step B as a white solid melting at 144-148°C. ^{1}H NMR ($CDCl_3$): δ 1.31 (s,9H), 2.39 (s,3H), 7.26-734 (m,2H), 7.35(s,1H), 7.63-7.66 (m,1H), 7.86-7.89 (m,1H), 8.46-8.49 (m,1H), 11.59 (br s,1H).

Step C: Preparation of *N*-[2-(6-hydrazino-3-pyridazinyl)-4-methylphenyl]-2,2-dimethylpropanamide

A solution of the title compound of Step B (1.0 g, 3.3 mmol) and hydrazine monohydrate (0.5 mL, 9.9 mmol) in 20 mL of *n*-butanol was heated at reflux for 4 h. After cooling to room temperature, the butanol was removed under vacuum and the residue so obtained was taken up in 80 mL diethyl ether. The organic solution was washed successively with 40 mL portions each of water and saturated aqueous NaCl, and then was dried over anhydrous magnesium sulfate. The solution was filtered and evaporated to dryness. The crude product was purified by chromatography on silica gel eluting with 5% methanol-dichloromethane to give 0.68 g (68%) of the title compound of Step C as a white solid melting at 153-156°C. ^{1}H NMR ($CDCl_3$): δ 1.30 (s,9H), 2.37 (s,3H), 4.00 (br s,2H), 6.27 (s,1H), 7.21-7.24 (m,2H), 7.30 (s,1H), 7.68-7.70 (m,1H), 8.44-8.46 (m,1H), 11.83 (br s,1H).

Step D: Preparation of 2,2-dimethyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1,2,4-triazolo[4,3-*b*]pyridazin-6-yl]phenyl]propanamide

A stirred solution of the title compound of Step C (0.68 g, 2.3 mmol) and 0.5 mL (3.6 mmol) of trifluoroacetic anhydride in 20 mL of pyridine was heated at reflux for 5 h. The dark solution was allowed to cool to room temperature. The volatiles were removed under reduced pressure and the residue was purified by chromatography on silica gel eluting with 50% ethyl acetate/hexane to afford 0.8 g (94%) of the title compound of Step D, a compound of the invention, as an oil. ^{1}H NMR ($CDCl_3$): δ 1.18 (s,9H), 2.42 (s,3H), 7.29 (s,1H), 7.37-7.40 (m,1H), 7.55-7.59 (m,1H), 7.90-7.93 (m,1H), 8.31-8.34 (m,1H), 8.77 (br s,1H).

EXAMPLE 5

Preparation of *N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]cyclopropanecarboxamide

To a solution of the title compound of Step F in Example 3 (0.75 g, 3.1 mmol) and pyridine (0.49 g, 6.2 mmol) in benzene (30 mL) was added cyclopropanecarbonyl chloride (0.42 g, 4.0 mmol). The mixture was stirred at 25 °C for 18 h. The reaction mixture was diluted with ethyl acetate (25 mL) and treated with 1N aqueous hydrochloric acid (10 mL). The organic layer was further washed with water and saturated aqueous NaCl (10 mL each), dried over magnesium sulfate and the solvent was then evaporated. The solid residue was triturated with hexane to give 0.72 g of the title compound of Example 5, a compound of the invention, as a solid melting at 106-107 °C. IR (mineral oil) 3300, 1674 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 0.9 (m,2H), 1.0

(m,2H), 1.4 (m,1H), 2.4 (s,3H), 6.77 (s,1H), 7.14 (s,1H), 7.2 (d,1H), 7.85 (s,1H), 8.3 (d,1H), 9.7 (s,1H).

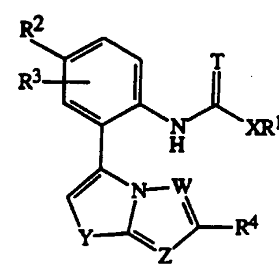
EXAMPLE 6

Preparation of 3-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]butanamide

To a solution of the title compound of Step F in Example 3 (0.75 g, 3.1 mmol) and pyridine (0.49 g, 6.2 mmol) in benzene (30 mL) was added isovaleryl chloride (0.48 g, 4.0 mmol). The mixture was stirred at 25 °C for 18 h. The reaction mixture was then diluted with ethyl acetate (25 mL) and treated with 1N aqueous hydrochloric acid (10 mL). The organic layer was further washed with water and saturated aqueous NaCl (10 mL each), dried over magnesium sulfate and the solvent was then evaporated. The solid residue was triturated with hexane to give 0.86 g of the title compound of Example 6, a compound of the invention, as a solid melting at 102-103 °C. IR (mineral oil) 3280, 1682 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 0.92 (d,6H), 2.1 (m,1H), 2.2 (d,2H), 2.38 (s,3H), 6.8 (s,1H), 7.15 (s,1H), 7.2 (d,1H), 7.8 (s,1H), 8.23 (d,1H), 9.5 (s,1H).

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 11 can be prepared. The following abbreviations are used in the Tables which follow: Me = methyl, C_6H_5 = phenyl and CN = cyano.

TABLE 1



T = O, R^3 = H, Y = S, W = N, Z = N,

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3
$C(CH_3)_3$	H	CF_3	OCH_3	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3	CF_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3	CF_3	Cl	CF_3

1-Me-cyclopropyl	Cl	CF_3	C_6H_5	Br	CF_3
CH_2CHCl_2	NO_2	CF_3	1-Me-cyclopropyl	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3	$CH(CH_3)_2$	CH_3	$SCHF_2$
$C(CH_3)_3$	H	SCF_3	$CH{=}C(CH_3)_2$	SCH_3	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	CF_3	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3	CF_3	Cl	SCF_3
$CH(CH_3)_2$	Br	Cl	CF_3	CH_2CH_3	Cl
cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
cyclopropyl	CH_3	Cl	OCH_2CH_3	CH_3	Br
CH_2CF_3	Br	Br	$OCH(CH_3)_2$	CH_3	OCH_2CF_3
OCH_3	CH_2CH_3	OCF_3	$CH(CH_3)_2$	CH_3	OCF_3
cyclobutyl	Br	OCF_3	$CH(CH_3)_2$	CH_3	CF_2Cl
cyclopropyl	CH_3	CF_2Cl	$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3
cyclopropyl	CH_2CH_3	NO_2	$CH(CH_3)_2$	CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

T = S, R^3 = H, Y = S, W = N, Z = N,

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$	$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = S, W = N, Z = CH,

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$	$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3

$C(CH_3)_3$	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3
1-Me-cyclopropyl	Cl	CF_3
CH_2CHCl_2	NO_2	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3
$C(CH_3)_3$	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3
$CH(CH_3)_2$	Br	Cl
cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	Cl
CH_2CF_3	Br	Br
OCH_3	CH_2CH_3	OCF_3
cyclobutyl	Br	OCF_3
cyclopropyl	CH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3
cyclopropyl	CH_2CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3
OCH_3	H	CF_3
$OCH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3
CF_3	Cl	CF_3
C_6H_5	Br	CF_3
1-Me-cyclopropyl	CH_3	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$
$CH{=}C(CH_3)_2$	SCH_3	SCF_3
CF_3	CH_3	SCF_3
CF_3	Cl	SCF_3
CF_3	CH_2CH_3	Cl
OCH_2CH_3	CH_3	CF_3
OCH_2CH_3	CH_3	Br
$OCH(CH_3)_2$	CH_3	OCH_2CF_3
$CH(CH_3)_2$	CH_3	OCF_3
$CH(CH_3)_2$	CH_3	CF_2Cl
$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
$CH(CH_3)_2$	CH_2CH_3	CF_3
$CH(CH_3)_2$	CH_3	NO_2
$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_2CH_3	CF_3

$T = S$, $R^3 = H$, $Y = S$, $W = N$, $Z = CH$,

<u>XR</u>^{1}	<u>R</u>^{2}	<u>R</u>^{4}
$C(CH_3)_3$	H	CF_3
cyclopropyl	CH_3	CF_3
CF_3	CH_3	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$
$CH(CH_3)_2$	CH_3	SCF_3
cyclopropyl	CH_3	SCF_3
CH_2CF_3	CH_3	NO_2
$CH(CH_3)_2$	H	Br
$CH_2CH(CH_3)_2$	CN	Cl
cyclopropyl	CH_3	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3
$CH{=}C(CH_3)_2$	Br	CF_2Cl

<u>XR</u>^{1}	<u>R</u>^{2}	<u>R</u>^{4}
CH_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3
C_6H_5	Cl	CF_3
cyclobutyl	H	SCF_3
$C(CH_3)_3$	SCH_3	SCF_3
cyclobutyl	H	NO_2
$C(CH_3)_3$	CH_3	Br
OCH_2CH_3	NO_2	Br
1-Me-cyclopropyl	CH_3	CF_3
C_6H_5	CN	OCF_3
$C(CH_3)_3$	NO_2	CF_2Cl
$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^3 = H$, $Y = S$, $W = CH$, $Z = N$,

XR[1]	R[2]	R[4]	XR[1]	R[2]	R[4]
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3
$C(CH_3)_3$	H	CF_3	OCH_3	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3	CF_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3	CF_3	Cl	CF_3
1-Me-cyclopropyl	Cl	CF_3	C_6H_5	Br	CF_3
CH_2CHCl_2	NO_2	CF_3	1-Me-cyclopropyl	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3	$CH(CH_3)_2$	CH_3	$SCHF_2$
$C(CH_3)_3$	H	SCF_3	$CH{=}C(CH_3)_2$	SCH_3	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	CF_3	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3	CF_3	Cl	SCF_3
$CH(CH_3)_2$	Br	Cl	CF_3	CH_2CH_3	Cl
cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
cyclopropyl	CH_3	Cl	OCH_2CH_3	CH_3	Br
CH_2CF_3	Br	Br	$OCH(CH_3)_2$	CH_3	OCH_2CF_3
OCH_3	CH_2CH_3	OCF_3	$CH(CH_3)_2$	CH_3	OCF_3
cyclobutyl	Br	OCF_3	$CH(CH_3)_2$	CH_3	CF_2Cl
cyclopropyl	CH_3	CF_2Cl	$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3
cyclopropyl	CH_2CH_3	NO_2	$CH(CH_3)_2$	CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

$T = S$, $R^3 = H$, $Y = S$, $W = CH$, $Z = N$,

XR[1]	R[2]	R[4]	XR[1]	R[2]	R[4]
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br

$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = S, W = CH, Z = CH,

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3
$C(CH_3)_3$	H	CF_3	OCH_3	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3	CF_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3	CF_3	Cl	CF_3
1-Me-cyclopropyl	Cl	CF_3	C_6H_5	Br	CF_3
CH_2CHCl_2	NO_2	CF_3	1-Me-cyclopropyl	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3	$CH(CH_3)_2$	CH_3	$SCHF_2$
$C(CH_3)_3$	H	SCF_3	$CH{=}C(CH_3)_2$	SCH_3	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	CF_3	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3	CF_3	Cl	SCF_3
$CH(CH_3)_2$	Br	Cl	CF_3	CH_2CH_3	Cl
cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
cyclopropyl	CH_3	Cl	OCH_2CH_3	CH_3	Br
CH_2CF_3	Br	Br	$OCH(CH_3)_2$	CH_3	OCH_2CF_3
OCH_3	CH_2CH_3	OCF_3	$CH(CH_3)_2$	CH_3	OCF_3
cyclobutyl	Br	OCF_3	$CH(CH_3)_2$	CH_3	CF_2Cl
cyclopropyl	CH_3	CF_2Cl	$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3
cyclopropyl	CH_2CH_3	NO_2	$CH(CH_3)_2$	CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

T = S, R^3 = H, Y = S, W = CH, Z = CH,

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3

$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^3 = H$, $Y = O$, $W = N$, $Z = CH$,

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$	$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3
$C(CH_3)_3$	H	CF_3	OCH_3	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3	CF_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3	CF_3	Cl	CF_3
1-Me-cyclopropyl	Cl	CF_3	C_6H_5	Br	CF_3
CH_2CHCl_2	NO_2	CF_3	1-Me-cyclopropyl	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3	$CH(CH_3)_2$	CH_3	$SCHF_2$
$C(CH_3)_3$	H	SCF_3	$CH{=}C(CH_3)_2$	SCH_3	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	CF_3	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3	CF_3	Cl	SCF_3
$CH(CH_3)_2$	Br	Cl	CF_3	CH_2CH_3	Cl
cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
cyclopropyl	CH_3	Cl	OCH_2CH_3	CH_3	Br
CH_2CF_3	Br	Br	$OCH(CH_3)_2$	CH_3	OCH_2CF_3
OCH_3	CH_2CH_3	OCF_3	$CH(CH_3)_2$	CH_3	OCF_3
cyclobutyl	Br	OCF_3	$CH(CH_3)_2$	CH_3	CF_2Cl
cyclopropyl	CH_3	CF_2Cl	$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3
cyclopropyl	CH_2CH_3	NO_2	$CH(CH_3)_2$	CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

T = S, R^3 = H, Y = O, W = N, Z = CH,

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$	$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = O, W = N, Z = N,

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$	$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$C(CH_3)_3$	CH_3	CF_3	OCH_3	CH_3	CF_3
$C(CH_3)_3$	H	CF_3	OCH_3	H	CF_3
$CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	CF_3	CF_3	CH_3	CF_3
$CH_2CH(CH_3)_2$	Cl	CF_3	CF_3	Cl	CF_3
1-Me-cyclopropyl	Cl	CF_3	C_6H_5	Br	CF_3
CH_2CHCl_2	NO_2	CF_3	1-Me-cyclopropyl	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	SCF_3	$CH(CH_3)_2$	CH_3	$SCHF_2$
$C(CH_3)_3$	H	SCF_3	$CH{=}C(CH_3)_2$	SCH_3	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	CF_3	CH_3	SCF_3
$CH(CH_3)_2$	Br	SCF_3	CF_3	Cl	SCF_3
$CH(CH_3)_2$	Br	Cl	CF_3	CH_2CH_3	Cl
cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
cyclopropyl	CH_3	Cl	OCH_2CH_3	CH_3	Br
CH_2CF_3	Br	Br	$OCH(CH_3)_2$	CH_3	OCH_2CF_3
OCH_3	CH_2CH_3	OCF_3	$CH(CH_3)_2$	CH_3	OCF_3
cyclobutyl	Br	OCF_3	$CH(CH_3)_2$	CH_3	CF_2Cl
cyclopropyl	CH_3	CF_2Cl	$CH_2CH(CH_3)_2$	OCH_3	CF_2Cl
cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3

cyclopropyl	CH_2CH_3	NO_2	$CH(CH_3)_2$	CH_3	NO_2
cyclopropyl	CH_2CH_3	$OCHF_2$	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

$T = O$, $R^3 = H$, $Y = O$, $W = CH$, $Z = N$,

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^3 = H$, $Y = O$, $W = CH$, $Z = CH$,

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = NH, W = N, Z = N

XR¹	R^2	R^4	XR¹	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = NH, W = N, Z = CH

XR¹	R^2	R^4	XR¹	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = NH, W = CH, Z = N

XR¹	R^2	R^4	XR¹	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3

$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^3 = H$, $Y = NH$, $W = CH$, $Z = CH$

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^3 = H$, $Y = NCH_3$, $W = N$, $Z = N$

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3

$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = NCH_3, W = N, Z = CH

XR[1]	R[2]	R[4]	XR[1]	R[2]	R[4]
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = -CH=CH-, W = N, Z = N

XR[1]	R[2]	R[4]	XR[1]	R[2]	R[4]
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = -CH=CH-, W = N, Z = CH

XR[1]	R[2]	R[4]	XR[1]	R[2]	R[4]
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3

cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = -CH=N-, W = N, Z = N

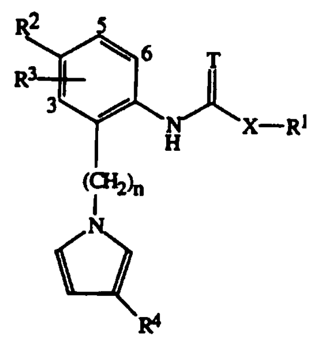
XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br
$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

T = O, R^3 = H, Y = -CH=N-, W = N, Z = CH

XR^1	R^2	R^4	XR^1	R^2	R^4
$C(CH_3)_3$	H	CF_3	CH_3	CH_3	CF_3
cyclopropyl	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_3	CF_3
CF_3	CH_3	CF_3	C_6H_5	Cl	CF_3
$CH(CH_3)_2$	CH_3	$SCHF_2$	cyclobutyl	H	SCF_3
$CH(CH_3)_2$	CH_3	SCF_3	$C(CH_3)_3$	SCH_3	SCF_3
cyclopropyl	CH_3	SCF_3	cyclobutyl	H	NO_2
CH_2CF_3	CH_3	NO_2	$C(CH_3)_3$	CH_3	Br

$CH(CH_3)_2$	H	Br	OCH_2CH_3	NO_2	Br
$CH_2CH(CH_3)_2$	CN	Cl	1-Me-cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	C_6H_5	CN	OCF_3
$OCH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	NO_2	CF_2Cl
$CH{=}C(CH_3)_2$	Br	CF_2Cl	$CH(CH_3)_2$	CH_3	CF_3

TABLE 2



$T = O,\ R^3 = H,\ n = 0$

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cycl butyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cycl butyl	CH_3	OCF_3

2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2F	CH_3	CF_3	CF_3	CH_3	OCF_3
CH_2CH_2Cl	CH_2CH_3	CF_3	CF_3	Br	Br
$C(CH_3)_3$	CH_2CH_3	CF_3	CCl_2CH_3	CH_3	Br
$C(CH_3)_2Br$	CH_3	Br	$CHCl_2$	CH_3	Cl
$CHClCH_3$	H	CF_3	$CH(CH_3)_2$	H	CF_3
$CH(CH_3)_2$	NO_2	Br	$CH_2CH(CH_3)_2$	NO_2	Br
$NHCH_3$	CH_3	CF_3	$N(CH_3)_2$	CH_3	CF_3
$NHCH(CH_3)_2$	CH_3	CF_3	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

$T = S$, $R^3 = H$, $n = 0$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^4 = CF_3$, $n = 0$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^3}$
$CH(CH_3)_2$	H	3-CH_3
cyclopropyl	H	5-Br
$CH_2CH(CH_3)_2$	H	6-CN

$T = O$, $R^3 = H$, $n = 1$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$	$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br

1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2F	CH_3	CF_3	CF_3	CH_3	OCF_3
CH_2CH_2Cl	CH_2CH_3	CF_3	CF_3	Br	Br
$C(CH_3)_3$	CH_2CH_3	CF_3	CCl_2CH_3	CH_3	Br
$C(CH_3)_2Br$	CH_3	Br	$CHCl_2$	CH_3	Cl
$CHClCH_3$	H	CF_3	$CH(CH_3)_2$	H	CF_3
$CH(CH_3)_2$	NO_2	Br	$CH_2CH(CH_3)_2$	NO_2	Br
$NHCH_3$	CH_3	CF_3	$N(CH_3)_2$	CH_3	CF_3
$NHCH(CH_3)_2$	CH_3	CF_3	$CH(CH_3)_2$	CH_3	$OCHF_2$
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

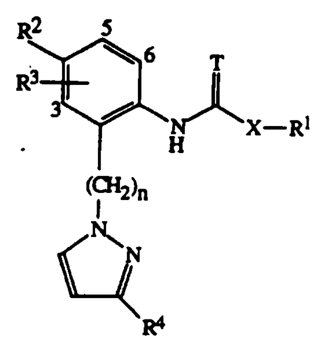
$T = S,\ R^3 = H,\ n = 1$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$CH(CH_3)_2$	CH_3	CF_3

$T = O,\ R^4 = CF_3,\ n = 0$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^3}$
$CH(CH_3)_2$	H	3-CH_3
cyclopropyl	H	5-Br
$CH_2CH(CH_3)_2$	H	6-CN

TABLE 3



$T = O,\ R^3 = H,\ n = 0$

$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$	$\underline{XR^1}$	$\underline{R^2}$	$\underline{R^4}$
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3

$CH(CH_3)_2$	Br	Br
$CH(CH_3)_2$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3
cyclopropyl	Br	Br
cyclopropyl	Br	CN
1-Me-cyclopropyl	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br
1-Me-cyclopropyl	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br
2-Me-cyclopropyl	Br	CF_3
$CHCl_2$	CH_3	CF_3
CH_2SCH_3	CH_3	CF_3
$(CH_2)_4CH_3$	CH_3	CF_3
CH_2CH_2Cl	CH_3	CF_3
$CH_2CH_2CF_3$	CH_2CH_3	CF_3
Ph	CH_3	Br
$C(CH_3)_3$	H	CF_3
$C(CH_3)_3$	NO_2	Br
$N(CH_3)CH(CH_3)_2$	CH_3	CF_3
cyclopentyl	CH_3	CF_3
$C(CH_3)_3$	Br	Br
$C(CH_3)_3$	Br	Cl
$OCH(CH_3)_2$	CH_3	CF_3
$OCH(CH_3)_2$	CH_3	OCF_3
$OCH(CH_3)_2$	Br	Br
$OCH(CH_3)_2$	Br	NO_2
$OCH_2CH(CH_3)_2$	CH_3	CF_3
$OCH_2CH(CH_3)_2$	CH_3	OCF_3
$OCH_2CH(CH_3)_2$	Br	Br
$OCH_2CH(CH_3)_2$	Br	CN
OCH_2CH_3	CH_3	CF_3
OCH_2CH_3	CH_3	OCF_3
OCH_2CH_3	Br	Br
OCH_2CH_3	Br	SCF_3
cyclobutyl	CH_3	CF_3
cyclobutyl	CH_3	OCF_3
cyclobutyl	Br	Br
cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3
CF_3	CH_3	OCF_3
CF_3	Br	Br
$CH(CH_3)_2$	CH_2CH_3	CF_3
$CHFCH_3$	CH_3	Br
$CH(CH_3)SCH_3$	CH_3	Cl
CF_3	H	CF_3
CH_2OCH_3	OCH_3	Br
$N(CH_3)OCH_3$	CH_3	CF_3
cyclopentyl	CH_2CH_3	CF_3

$T = S$, $R^3 = H$, $n = 0$

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$
$CH_2CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^4 = CF_3$, $n = 0$

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^3$
$CH(CH_3)_2$	H	3-Br
cyclopropyl	H	5-CN
$CH_2CH(CH_3)_2$	H	6-NO_2

T = O, R^3 = H, n = 1

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
$CHCl_2$	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2SCH_3	CH_3	CF_3	CF_3	CH_3	OCF_3
$(CH_2)_4CH_3$	CH_3	CF_3	CF_3	Br	Br
CH_2CH_2Cl	CH_3	CF_3	$CH(CH_3)_2$	CH_2CH_3	CF_3
$CH_2CH_2CF_3$	CH_2CH_3	CF_3	$CHFCH_3$	CH_3	Br
Ph	CH_3	Br	$CH(CH_3)SCH_3$	CH_3	Cl
$C(CH_3)_3$	H	CF_3	CF_3	H	CF_3
$C(CH_3)_3$	NO_2	Br	CH_2OCH_3	OCH_3	Br
$N(CH_3)CH(CH_3)_2$	CH_3	CF_3	$N(CH_3)OCH_3$	CH_3	CF_3
cyclopentyl	CH_3	CF_3	cyclopentyl	CH_2CH_3	CF_3

T = S, R^3 = H, n = 0

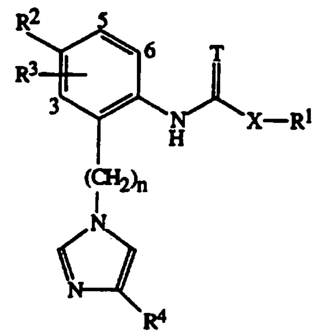
XR^1	R^2	R^4
$CH_2CH(CH_3)_2$	CH_3	CF_3

T = O, R^4 = CF_3, n = 0

XR^1	R^2	R^3
$CH(CH_3)_2$	H	3-Br

cyclopropyl	H	5-CN
$CH_2CH(CH_3)_2$	H	$6\text{-}NO_2$

TABLE 4



T = O, R^3 = H, n = 0

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_2CH_2Br	CH_3	CF_3	CF_3	CH_3	CF_3

$(CH_2)_2CH_3$	CH_3	CF_3
$CHBrCH(CH_3)_2$	CH_3	CF_3
$CH{=}C(CH_2Cl)_2$	CH_3	CF_3
$C(CH_3)_2CH_2Cl$	CH_2CH_3	CF_3
$CH_2C(CH_3){=}CH_2$	CH_3	Cl
$C(CH_3)_2OCH_3$	SCH_3	Br
$NHCH_2CH_3$	Br	CF_3
CF_3	CH_3	OCF_3
CF_3	Br	Br
cyclopropyl	CH_2CH_3	CF_3
$C(CH_3)_2OCH_3$	CH_3	Br
CH_2CHF_2	Br	Br
CF_3	CH_2CH_3	Br
$N(CH_3)CH_2CH_3$	Br	CF_3

$T = S,\ R^3 = H,\ n = 0$

XR[1]	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3

$T = O,\ R^4 = CF_3,\ n = 0$

XR[1]	R^2	R^3
$CH(CH_3)_2$	H	3-F
$CH(CH_3)_2$	H	5-SCF_3
$CH(CH_3)_2$	H	6-Cl

$T = O,\ R^3 = H,\ n = 1$

XR[1]	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br
$CH(CH_3)_2$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3
cyclopropyl	CH_3	OCF_3
cyclopropyl	Br	Br
cyclopropyl	Br	CN
1-Me-cyclopropyl	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br
1-Me-cyclopropyl	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br
2-Me-cyclopropyl	Br	CF_3

XR[1]	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3
$C(CH_3)_3$	CH_3	OCF_3
$C(CH_3)_3$	Br	Br
$C(CH_3)_3$	Br	Cl
$OCH(CH_3)_2$	CH_3	CF_3
$OCH(CH_3)_2$	CH_3	OCF_3
$OCH(CH_3)_2$	Br	Br
$OCH(CH_3)_2$	Br	NO_2
$OCH_2CH(CH_3)_2$	CH_3	CF_3
$OCH_2CH(CH_3)_2$	CH_3	OCF_3
$OCH_2CH(CH_3)_2$	Br	Br
$OCH_2CH(CH_3)_2$	Br	CN
OCH_2CH_3	CH_3	CF_3
OCH_2CH_3	CH_3	OCF_3
OCH_2CH_3	Br	Br
OCH_2CH_3	Br	SCF_3
cyclobutyl	CH_3	CF_3
cyclobutyl	CH_3	OCF_3
cyclobutyl	Br	Br
cyclobutyl	Br	CF_3

CH_2CH_2Br	CH_3	CF_3	CF_3	CH_3	CF_3
$(CH_2)_2CH_3$	CH_3	CF_3	CF_3	CH_3	OCF_3
$CHBrCH(CH_3)_2$	CH_3	CF_3	CF_3	Br	Br
$CH{=}C(CH_2Cl)_2$	CH_3	CF_3	cyclopropyl	CH_2CH_3	CF_3
$C(CH_3)_2CH_2Cl$	CH_2CH_3	CF_3	$C(CH_3)_2OCH_3$	CH_3	Br
$CH_2C(CH_3){=}CH_2$	CH_3	Cl	CH_2CHF_2	Br	Br
$C(CH_3)_2OCH_3$	SCH_3	Br	CF_3	CH_2CH_3	Br
$NHCH_2CH_3$	Br	CF_3	$N(CH_3)CH_2CH_3$	Br	CF_3

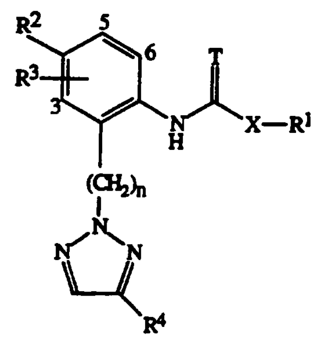
$T = S,\ R^3 = H,\ n = 0$

XR^1	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3

$T = O,\ R^4 = CF_3,\ n = 0$

XR^1	R^2	R^3
$CH(CH_3)_2$	H	3-F
$CH(CH_3)_2$	H	5-SCF_3
$CH(CH_3)_2$	H	6-Cl

TABLE 5



$T = O,\ R^3 = H,\ n = 0$

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cycl propyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3

cyclopropyl	CH_3	OCF_3
cyclopropyl	Br	Br
cyclopropyl	Br	CN
1-Me-cyclopropyl	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br
1-Me-cyclopropyl	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br
2-Me-cyclopropyl	Br	CF_3
CH_2-cyclopropyl	CH_3	CF_3
CH_2OCH_3	CH_3	CF_3
$C(CH_3)=CH_2$	CH_3	CF_3
$C(CH_3)_2Br$	CH_3	CF_3
1-Me-cyclopropyl	CH_2CH_3	CF_3
$CH=C(CH_3)_2$	CH_3	Br
$CH(CH_3)_2$	CH_2OCH_3	CF_3
$OCH_2CH(CH_3)_2$	CH_3	OCF_3
$OCH_2CH(CH_3)_2$	Br	Br
$OCH_2CH(CH_3)_2$	Br	CN
OCH_2CH_3	CH_3	CF_3
OCH_2CH_3	CH_3	OCF_3
OCH_2CH_3	Br	Br
OCH_2CH_3	Br	SCF_3
cyclobutyl	CH_3	CF_3
cyclobutyl	CH_3	OCF_3
cyclobutyl	Br	Br
cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3
CF_3	CH_3	OCF_3
CF_3	Br	Br
$CH_2CH(CH_3)_2$	CH_2CH_3	CF_3
$CH(CH_3)CH_2CH_3$	CH_3	Br
CH_2SCH_3	CH_2SCH_3	Br
$N(CH_3)OCH_3$	CH_3	CF_3

$T = S$, $R^3 = H$, $n = 0$

XR[1]	R^2	R^4
cyclopropyl	CH_3	CF_3
cyclobutyl	CH_3	CF_3

$T = O$, $R^4 = CF_3$, $n = 0$

XR[1]	R^2	R^3
$CH(CH_3)_2$	H	3-CH_2OCH_3
$CH(CH_3)_2$	H	5-$N(CH_3)_2$
$CH(CH_3)_2$	H	6-CH_2SCH_3

$T = O$, $R^3 = H$, $n = 1$

XR[1]	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br
$CH(CH_3)_2$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3

XR[1]	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3
$C(CH_3)_3$	CH_3	OCF_3
$C(CH_3)_3$	Br	Br
$C(CH_3)_3$	Br	Cl
$OCH(CH_3)_2$	CH_3	CF_3
$OCH(CH_3)_2$	CH_3	OCF_3
$OCH(CH_3)_2$	Br	Br
$OCH(CH_3)_2$	Br	NO_2
$OCH_2CH(CH_3)_2$	CH_3	CF_3

cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_2-cyclopropyl	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2OCH_3	CH_3	CF_3	CF_3	CH_3	OCF_3
$C(CH_3){=}CH_2$	CH_3	CF_3	CF_3	Br	Br
$C(CH_3)_2Br$	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_2CH_3	CF_3
1-Me-cyclopropyl	CH_2CH_3	CF_3	$CH(CH_3)CH_2CH_3$	CH_3	Br
$CH{=}C(CH_3)_2$	CH_3	Br	CH_2SCH_3	CH_2SCH_3	Br
$CH(CH_3)_2$	CH_2OCH_3	CF_3	$N(CH_3)OCH_3$	CH_3	CF_3

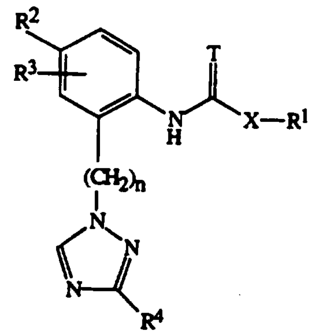
T = S, R^3 = H, n = 0

XR[1]	R^2	R^4
cyclopropyl	CH_3	CF_3
cyclobutyl	CH_3	CF_3

T = O, $R^4 = CF_3$, n = 0

XR[1]	R^2	R^3
$CH(CH_3)_2$	H	3-CH_2OCH_3
$CH(CH_3)_2$	H	5-$N(CH_3)_2$
$CH(CH_3)_2$	H	6-CH_2SCH_3

TABLE 6



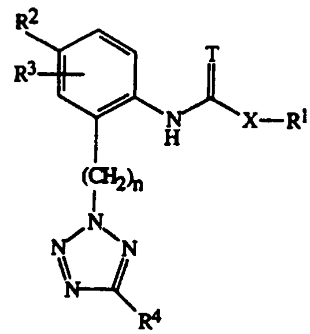
$T = O$, $R^3 = H$, $n = 0$

XR¹	R²	R⁴	XR¹	R²	R⁴
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3	CF_3	CH_3	OCF_3
CF_3	Br	Br	$CH(CH_3)_2$	CH_3	$OCHF_2$

T = O, R^3 = H, n = 1

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3	CF_3	CH_3	OCF_3
CF_3	Br	Br	$CH(CH_3)_2$	CH_3	$OCHF_2$

TABLE 7



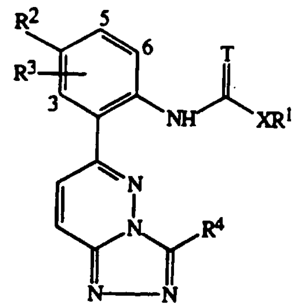
$T = O$, $R^3 = H$, $n = 0$

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3	CF_3	CH_3	OCF_3
CF_3	Br	Br	$CH(CH_3)_2$	CH_3	$OCHF_2$

T = O, R^3 = H, n = 1

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CF_3	CH_3	CF_3	CF_3	CH_3	OCF_3
CF_3	Br	Br	$CH(CH_3)_2$	CH_3	$OCHF_2$

TABLE 8



$T = O, R^3 = H$

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2F	CH_3	CF_3	CF_3	CH_3	OCF_3
CH_2CH_2Cl	CH_2CH_3	CF_3	CF_3	Br	Br
CCl_2CH_3	CH_3	Br	$C(CH_3)_2$	CH_2CH_3	CF_3
$CHCl_2$	CH_3	Cl	$C(CH_3)_2Br$	CH_3	Br

$CH(CH_3)_2$	H	CF_3	$CHClCH_3$	H	CF_3
$CH_2CH(CH_3)_2$	NO_2	Br	$CH(CH_3)_2$	NO_2	Br
$N(CH_3)_2$	CH_3	CF_3	$NHCH_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	$OCHF_2$	$NHCH(CH_3)_2$	CH_3	CF_3

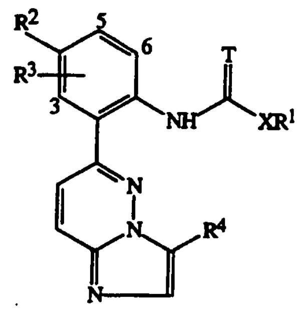
$T = S$, $R^3 = H$

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$
$CH(CH_3)_2$	CH_3	CF_3

$T = O$, $R^4 = CF_3$

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^3$
$CH(CH_3)_2$	H	3-CH_3
cyclopropyl	H	5-Br
$CH_2CH(CH_3)_2$	H	6-CN

TABLE 9



$T = O$, $R^3 = H$

$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$	$\underline{XR}^1$	$\underline{R}^2$	$\underline{R}^4$
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cycl propyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3

1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
$CHCl_2$	CH_3	CF_3	CF_3	CH_3	OCF_3
CH_2SCH_3	CH_3	CF_3	CF_3	Br	Br
$(CH_2)_4CH_3$	CH_3	CF_3	CH_2CH_2Cl	CH_3	CF_3
$CH(CH_3)_2$	CH_2CH_3	CF_3	$CH_2CH_2CF_3$	CH_2CH_3	CF_3
$CHFCH_3$	CH_3	Br	Ph	CH_3	Br
$CH(CH_3)SCH_3$	CH_3	Cl	$C(CH_3)_3$	H	CF_3
CF_3	H	CF_3	$C(CH_3)_3$	NO_2	Br
CH_2OCH_3	OCH_3	Br	$N(CH_3)CH(CH_3)_2$	CH_3	CF_3
$N(CH_3)OCH_3$	CH_3	CF_3	$CH(CH_3)_2$	CH_3	$OCHF_2$

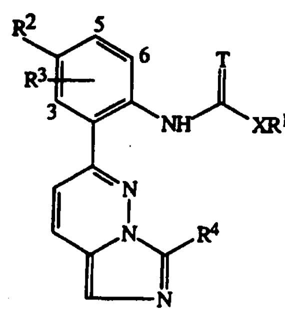
T = S, R^3 = H

XR^1	R^2	R^4
$CH_2CH(CH_3)_2$	CH_3	CF_3

T = O, $R^4 = CF_3$

XR^1	R^2	R^3
$CH(CH_3)_2$	H	3-Br
cyclopropyl	H	5-CN
$CH_2CH(CH_3)_2$	H	6-NO_2

TABLE 10



T = O, R^3 = H

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3

$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2CH_2Br	CH_3	CF_3	CF_3	CH_3	OCF_3
$(CH_2)_2CH_3$	CH_3	CF_3	CF_3	Br	Br
$CHBrCH(CH_3)_2$	CH_3	CF_3	$CH{=}C(CH_2Cl)_2$	CH_3	CF_3
cyclopropyl	CH_2CH_3	CF_3	$C(CH_3)_2CH_2Cl$	CH_2CH_3	CF_3
$C(CH_3)_2OCH_3$	CH_3	Br	$CH_2C(CH_3){=}CH_2$	CH_3	Cl
CH_2CHF_2	Br	Br	$C(CH_3)_2OCH_3$	SCH_3	Br
CF_3	CH_2CH_3	Br	$NHCH_2CH_3$	Br	CF_3
$N(CH_3)CH_2CH_3$	Br	CF_3	$CH(CH_3)_2$	CH_3	$OCHF_2$

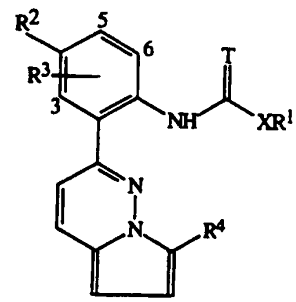
T = S, R^3 = H

XR^1	R^2	R^4
$C(CH_3)_3$	CH_3	CF_3

T = O, R^4 = CF_3

XR^1	R^2	R^3
$CH(CH_3)_2$	H	3-F
$CH(CH_3)_2$	H	5-SCF_3
$CH(CH_3)_2$	H	6-Cl

TABLE 11



T = O, R^3 = H

XR^1	R^2	R^4	XR^1	R^2	R^4
$CH(CH_3)_2$	CH_3	CF_3	$C(CH_3)_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_3	OCF_3	$C(CH_3)_3$	CH_3	OCF_3
$CH(CH_3)_2$	Br	Br	$C(CH_3)_3$	Br	Br
$CH(CH_3)_2$	Br	Cl	$C(CH_3)_3$	Br	Cl
$CH_2CH(CH_3)_2$	CH_3	CF_3	$OCH(CH_3)_2$	CH_3	CF_3
$CH_2CH(CH_3)_2$	CH_3	OCF_3	$OCH(CH_3)_2$	CH_3	OCF_3
$CH_2CH(CH_3)_2$	Br	Br	$OCH(CH_3)_2$	Br	Br
$CH_2CH(CH_3)_2$	Br	NO_2	$OCH(CH_3)_2$	Br	NO_2
cyclopropyl	CH_3	CF_3	$OCH_2CH(CH_3)_2$	CH_3	CF_3
cyclopropyl	CH_3	OCF_3	$OCH_2CH(CH_3)_2$	CH_3	OCF_3
cyclopropyl	Br	Br	$OCH_2CH(CH_3)_2$	Br	Br
cyclopropyl	Br	CN	$OCH_2CH(CH_3)_2$	Br	CN
1-Me-cyclopropyl	CH_3	CF_3	OCH_2CH_3	CH_3	CF_3
1-Me-cyclopropyl	CH_3	OCF_3	OCH_2CH_3	CH_3	OCF_3
1-Me-cyclopropyl	Br	Br	OCH_2CH_3	Br	Br
1-Me-cyclopropyl	Br	SCF_3	OCH_2CH_3	Br	SCF_3
2-Me-cyclopropyl	CH_3	CF_3	cyclobutyl	CH_3	CF_3
2-Me-cyclopropyl	CH_3	OCF_3	cyclobutyl	CH_3	OCF_3
2-Me-cyclopropyl	Br	Br	cyclobutyl	Br	Br
2-Me-cyclopropyl	Br	CF_3	cyclobutyl	Br	CF_3
CH_3	CH_3	CF_3	CF_3	CH_3	CF_3
CH_2-cyclopropyl	CH_3	CF_3	CF_3	CH_3	OCF_3
CH_2OCH_3	CH_3	CF_3	CF_3	Br	Br
$C(CH_3)=CH_2$	CH_3	CF_3	$CH_2CH(CH_3)_2$	CH_2CH_3	CF_3
$C(CH_3)_2Br$	CH_3	CF_3	$CH(CH_3)CH_2CH_2$	CH_3	Br

1-Me-cyclopropyl	CH_2CH_3	CF_3	CH_2SCH_3	CH_2SCH_3	Br
$CH{=}C(CH_3)_2$	CH_3	Br	$N(CH_3)OCH_3$	CH_3	CF_3
$CH(CH_3)_2$	CH_2OCH_3	CF_3	$CH(CH_3)_2$	CH_3	$OCHF_2$

$T = S$, $R^3 = H$

XR^1	R^2	R^4
cyclopropyl	CH_3	CF_3
cyclobutyl	CH_3	CF_3

$T = O$, $R^4 = CF_3$

XR^1	R^2	R^3
$CH(CH_3)_2$	H	3-CH_2OCH_3
$CH(CH_3)_2$	H	5-$N(CH_3)_2$
$CH(CH_3)_2$	H	6-CH_2SCH_3

Formulation/Utility

Compounds of this invention will generally be used as a formulation or composition with an agriculturally suitable carrier comprising at least one of a liquid diluent, a solid diluent or a surfactant. The formulation or composition ingredients are selected to be consistent with the physical properties of the active ingredient, mode of application and environmental factors such as soil type, moisture and temperature. Useful formulations include liquids such as solutions (including emulsifiable concentrates), suspensions, emulsions (including microemulsions and/or suspoemulsions) and the like which optionally can be thickened into gels. Useful formulations further include solids such as dusts, powders, granules, pellets, tablets, films, and the like which can be water-dispersible ("wettable") or water-soluble. Active ingredient can be (micro)encapsulated and further formed into a suspension or solid formulation; alternatively the entire formulation of active ingredient can be encapsulated (or "overcoated"). Encapsulation can control or delay release of the active ingredient. Sprayable formulations can be extended in suitable media and used at spray volumes from about one to several hundred liters per hectare. High-strength compositions are primarily used as intermediates for further formulation.

The formulations will typically contain effective amounts of active ingredient, diluent and surfactant within the following approximate ranges which add up to 100 percent by weight.

	Weight Percent		
	Active Ingredient	Diluent	Surfactant
Water-Dispersible and Water-soluble Granules, Tablets and Powders.	5–90	0–94	1–15
Suspensions, Emulsions, Solutions (including Emulsifiable Concentrates)	5–50	40–95	0–15
Dusts	1–25	70–99	0–5
Granules and Pellets	0.01–99	5–99.99	0–15
High Strength Compositions	90–99	0–10	0–2

Typical solid diluents are described in Watkins, et al., *Handbook of Insecticide Dust Diluents and Carriers*, 2nd Ed., Dorland Books, Caldwell, New Jersey. Typical liquid diluents are described in Marsden, *Solvents Guide*, 2nd Ed., Interscience, New York, 1950. *McCutcheon's Detergents and Emulsifiers Annual*, Allured Publ. Corp., Ridgewood, New Jersey, as well as Sisely and Wood, *Encyclopedia of Surface Active Agents*, Chemical Publ. Co., Inc., New York, 1964, list surfactants and recommended uses. All formulations can contain minor amounts of additives to reduce foam, caking, corrosion, microbiological growth and the like, or thickeners to increase viscosity.

Surfactants include, for example, polyethoxylated alcohols, polyethoxylated alkylphenols, polyethoxylated sorbitan fatty acid esters, dialkyl sulfosuccinates, alkyl sulfates, alkylbenzene sulfonates, organosilicones, *N,N*-dialkyltaurates, lignin sulfonates, naphthalene sulfonate formaldehyde condensates, polycarboxylates, and polyoxyethylene/polyoxypropylene block copolymers. Solid diluents include, for example, clays such as bentonite, montmorillonite, attapulgite and kaolin, starch, sugar, silica, talc, diatomaceous earth, urea, calcium carbonate, sodium carbonate and bicarbonate, and sodium sulfate. Liquid diluents include, for example, water, *N,N*-dimethylformamide, dimethyl sulfoxide, *N*-alkylpyrrolidone, ethylene glycol, polypropylene glycol, paraffins, alkylbenzenes, alkylnaphthalenes, oils of olive, castor, linseed, tung, sesame, corn, peanut, cotton-seed, soybean, rape-seed and coconut, fatty acid esters, ketones such as cyclohexanone, 2-heptanone, isophorone and 4-hydroxy-4-methyl-2-pentanone, and alcohols such as methanol, cyclohexanol, decanol and tetrahydrofurfuryl alcohol.

Solutions, including emulsifiable concentrates, can be prepared by simply mixing the ingredients. Dusts and powders can be prepared by blending and, usually, grinding as in a hammer mill or fluid-energy mill. Suspensions are usually prepared by wet-milling; see, for example, U.S. 3,060,084. Granules and pellets can be prepared by spraying the

active material upon preformed granular carriers or by agglomeration techniques. See Browning, "Agglomeration", *Chemical Engineering*, December 4, 1967, pp 147-48, *Perry's Chemical Engineer's Handbook*, 4th Ed., McGraw-Hill, New York, 1963, pages 8-57 and following, and WO 91/13546. Pellets can be prepared as described in U.S. 4,172,714. Water-dispersible and water-soluble granules can be prepared as taught in U.S. 4,144,050, U.S. 3,920,442 and DE 3,246,493. Tablets can be prepared as taught in U.S. 5,180,587, U.S. 5,232,701 and U.S. 5,208,030. Films can be prepared as taught in GB 2,095,558 and U.S. 3,299,566.

For further information regarding the art of formulation, see U.S. 3,235,361, Col. 6, line 16 through Col. 7, line 19 and Examples 10-41; U.S. 3,309,192, Col. 5, line 43 through Col. 7, line 62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132, 138-140, 162-164, 166, 167 and 169-182; U.S. 2,891,855, Col. 3, line 66 through Col. 5, line 17 and Examples 1-4; Klingman, *Weed Control as a Science*, John Wiley and Sons, Inc., New York, 1961, pp 81-96; and Hance et al., *Weed Control Handbook*, 8th Ed., Blackwell Scientific Publications, Oxford, 1989.

In the following Examples, all percentages are by weight and all formulations are prepared in conventional ways. Compound numbers refer to compounds in Index Tables A-D.

Example A

High Strength Concentrate

Compound 4	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%.

Example B

Wettable Powder

Compound 41	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%.

Example C

Granule

Compound 4	10.0%
attapulgite granules (low volatile matter, 0.71/0.30 mm; U.S.S. No. 25–50 sieves)	90.0%.

Example D

Extruded Pellet

Compound 41	25.0%
anhydrous sodium sulfate	10.0%
crude calcium ligninsulfonate	5.0%
sodium alkylnaphthalenesulfonate	1.0%
calcium/magnesium bentonite	59.0%.

Test results indicate that the compounds of the present invention are highly active preemergent and postemergent herbicides or plant growth regulants. Many of them have utility for broad-spectrum pre- and/or postemergence weed control in areas where complete control of all vegetation is desired such as around fuel storage tanks, industrial storage areas, parking lots, drive-in theaters, air fields, river banks, irrigation and other waterways, around billboards and highway and railroad structures. Some of the compounds are useful for the control of selected grass and broadleaf weeds with tolerance to important agronomic crops which include but are not limited to barley, cotton, wheat, rape, sugar beets, corn (maize), soybeans, rice, oats, peanuts, vegetables, tomato, potato, and plantation crops including coffee, cocoa, oil palm, rubber, sugarcane, citrus, grapes, fruit trees, nut trees, banana, plantain, pineapple, hops, tea, forests such as eucalyptus and conifers, e.g., loblolly pine, and turf species, e.g., Kentucky bluegrass, St. Augustine grass, Kentucky fescue and Bermuda grass. Those skilled in the art will appreciate that not all compounds are equally effective against all weeds. Alternatively, the subject compounds are useful to modify plant growth.

Compounds of this invention can be used alone or in combination with other commercial herbicides, insecticides or fungicides. Compounds of this invention can also be used in combination with commercial herbicide safeners such as benoxacor, dichlormid and furilazole to increase safety to certain crops. A mixture of one or more of the following herbicides with a compound of this invention may be particularly useful for weed control: acetochlor, acifluorfen and its sodium salt, aclonifen, acrolein (2-propenal), alachlor, ametryn, amidosulfuron, amitrole, ammonium sulfamate, anilofos, asulam, atrazine, azimsulfuron, benazolin, benazolin-ethyl, benfluralin, benfuresate, bensulfuron-methyl, bensulide, bentazone, bifenox, bromacil, bromoxynil, bromoxynil octanoate, butachlor, butralin, butylate, chlomethoxyfen, chloramben, chlorbromuron, chloridazon, chlorimuron-ethyl, chlornitrofen, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, cinmethylin, cinosulfuron, clethodim, clomazone, clopyralid, clopyralid-olamine, cyanazine, cycloate, cyclosulfamuron, 2,4-D and its butotyl, butyl, isoctyl and isopropyl esters and its dimethylammonium, diolamine and trolamine salts, daimuron, dalapon, dalapon-sodium, dazomet, 2,4-DB and its

dimethylammonium, potassium and sodium salts, desmedipham, desmetryn, dicamba and its diglycolammonium, dimethylammonium, potassium and sodium salts, dichlobenil, dichlorprop, diclofop-methyl, 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid (AC 263,222), difenzoquat metilsulfate, diflufenican, dimepiperate, dimethenamid, dimethylarsinic acid and its sodium salt, dinitramine, diphenamid, diquat dibromide, dithiopyr, diuron, DNOC, endothal, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethyl α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoate (F8426), fenoxaprop-ethyl, fenoxaprop-P-ethyl, fenuron, fenuron-TCA, flamprop-methyl, flamprop-M-isopropyl, flamprop-M-methyl, flazasulfuron, fluazifop-butyl, fluazifop-P-butyl, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluoroglycofen-ethyl, flupoxam, fluridone, flurochloridone, fluroxypyr, fomesafen, fosamine-ammonium, glufosinate, glufosinate-ammonium, glyphosate, glyphosate-isopropylammonium, glyphosate-sesquisodium, glyphosate-trimesium, halosulfuron-methyl, haloxyfop-etotyl, haloxyfop-methyl, hexazinone, imazamethabenz-methyl, imazamox (AC 299 263), imazapyr, imazaquin, imazaquin-ammonium, imazethapyr, imazethapyr-ammonium, imazosulfuron, ioxynil, ioxynil octanoate, ioxynil-sodium, isoproturon, isouron, isoxaben, isoxaflutole (RPA 201772), lactofen, lenacil, linuron, maleic hydrazide, MCPA and its dimethylammonium, potassium and sodium salts, MCPA-isoctyl, mecoprop, mecoprop-P, mefenacet, mefluidide, metam-sodium, methabenzthiazuron, methyl [[2-chloro-4-fluoro-5-[(tetrahydro-3-oxo-1*H*,3*H*-[1,3,4]thiadiazolo[3,4-*a*]pyridazin-1-ylidene)amino]phenyl]thioacetate (KIH 9201), methylarsonic acid and its calcium, monoammonium, monosodium and disodium salts, methyl [[[1-[5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrophenyl]-2-methoxyethylidene]amino]oxy]acetate (AKH-7088), methyl 5-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-1-(2-pyridinyl)-1*H*-pyrazole-4-carboxylate (NC-330), metobenzuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron-methyl, molinate, monolinuron, napropamide, naptalam, neburon, nicosulfuron, norflurazon, oryzalin, oxadiazon, 3-oxetanyl 2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoate (CGA 277476), oxyfluorfen, paraquat dichloride, pebulate, pendimethalin, perfluidone, phenmedipham, picloram, picloram-potassium, pretilachlor, primisulfuron-methyl, prometon, prometryn, propachlor, propanil, propaquizafop, propazine, propham, propyzamide, prosulfuron, pyrazolynate, pyrazosulfuron-ethyl, pyridate, pyrithiobac, pyrithiobac-sodium, quinclorac, quizalofop-ethyl, quizalofop-P-ethyl, quizalofop-P-tefuryl, rimsulfuron, sethoxydim, siduron, simazine, sulcotrione (ICIA0051), sulfentrazone, sulfometuron-methyl, TCA, TCA-sodium, tebuthiuron,

terbacil, terbuthylazine, terbutryn, thenylchlor, thiafluamide (BAY 11390), thifensulfuron-methyl, thiobencarb, tralkoxydim, tri-allate, triasulfuron, tribenuron-methyl, triclopyr, triclopyr-butotyl, triclopyr-triethylammonium, tridiphane, trifluralin, triflusulfuron-methyl, and vernolate.

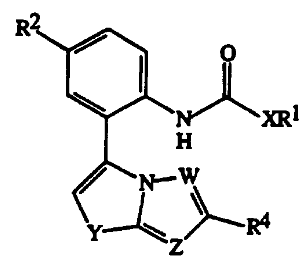
In certain instances, combinations with other herbicides having a similar spectrum of control but a different mode of action will be particularly advantageous for preventing the development of resistant weeds.

Preferred for better control of undesired vegetation (e.g., lower use rate, broader spectrum of weeds controlled, or enhanced crop safety) or for preventing the development of resistant weeds are mixtures of a compound of this invention with a herbicide selected from the group atrazine, chlorimuron-ethyl, imazaquin, imazaquin-ammonium, imazethapyr, imazethapyr-ammonium, norflurazon, and pyrithiobac. Specifically preferred mixtures (compound numbers refer to compounds in Index Tables A-D) are selected from the group: compound 1 and atrazine; compound 1 and chlorimuron-ethyl; compound 1 and imazaquin; compound 1 and imazethapyr; compound 1 and norflurazon; compound 1 and pyrithiobac; compound 4 and atrazine; compound 4 and chlorimuron-ethyl; compound 4 and imazaquin; compound 4 and imazethapyr; compound 4 and norflurazon; compound 4 and pyrithiobac; compound 40 and atrazine; compound 40 and chlorimuron-ethyl; compound 40 and imazaquin; compound 40 and imazethapyr; compound 40 and norflurazon; compound 40 and pyrithiobac; compound 41 and atrazine; compound 41 and chlorimuron-ethyl; compound 41 and imazaquin; compound 41 and imazethapyr; compound 41 and norflurazon; compound 41 and pyrithiobac; compound 42 and atrazine; compound 42 and chlorimuron-ethyl; compound 42 and imazaquin; compound 42 and imazethapyr; compound 42 and norflurazon; compound 42 and pyrithiobac; compound 46 and atrazine; compound 46 and chlorimuron-ethyl; compound 46 and imazaquin; compound 46 and imazethapyr; compound 46 and norflurazon; compound 46 and pyrithiobac; compound 133 and atrazine; compound 133 and chlorimuron-ethyl; compound 133 and imazaquin; compound 133 and imazethapyr; compound 133 and norflurazon; and compound 133 and pyrithiobac.

A herbicidally effective amount of the compounds of this invention is determined by a number of factors. These factors include: formulation selected, method of application, amount and type of vegetation present, growing conditions, etc. In general, a herbicidally effective amount of compounds of this invention is 0.001 to 20 kg/ha with a preferred range of 0.004 to 1.0 kg/ha. One skilled in the art can easily determine the herbicidally effective amount necessary for the desired level of weed control.

The following Tests demonstrate the control efficacy of the compounds of this invention against specific weeds. The weed control afforded by the compounds is not limited, however, to these species. See Index Tables A-D for compound descriptions. The following abbreviations are used in the Index Tables which follow: *n* = normal, *i* = iso, Pr = propyl, *i*-Pr = isopropyl, Bu = butyl, Ph = phenyl, and NO_2 = nitro. The abbreviation "dec" indicates that the compound appeared to decompose on melting. The abbreviation "Ex." stands for "Example" and is followed by a number indicating in which example the compound is prepared.

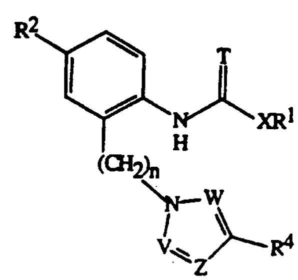
INDEX TABLE A



Cmpd No.	X	Y	Z	W	R^1	R^2	R^4	m.p. (°C)
1 Ex. 1	bond	S	N	N	$CH_2CH(CH_3)_2$	CH_3	CF_3	177-178
2	O	S	N	N	$CH(CH_3)_2$	CH_3	CF_3	149-150
3	bond	S	N	N	$CH(CH_3)_2$	CH_3	CF_3	197-198
4	bond	S	N	N	cyclopropyl	CH_3	CF_3	200-201
5	bond	S	N	N	CF_3	CH_3	CF_3	64 (dec)
6	bond	S	N	N	$C(CH_3)_3$	CH_3	CF_3	168-170
7	bond	S	N	N	cyclobutyl	CH_3	CF_3	200-201
8	bond	S	N	N	cyclopentyl	CH_3	CF_3	179-182
9	bond	S	N	N	1-CH_3-cyclopropyl	CH_3	CF_3	152-155
10	bond	S	N	N	2-CH_3-cyclopropyl	CH_3	CF_3	180-184
11	bond	S	N	N	CF_2Cl	CH_3	CF_3	104-106
12	bond	S	N	N	cyclopentyl	CH_2CH_3	CF_3	167-170
13	bond	S	N	N	cyclobutyl	CH_2CH_3	CF_3	176-178
14	bond	S	N	N	cyclopropyl	CH_2CH_3	CF_3	184-186
15	bond	S	N	N	1-CH_3-cyclopropyl	CH_2CH_3	CF_3	139-142
16	bond	S	N	N	1-CH_3-cyclopropyl	Cl	CF_3	150-153
17	bond	S	N	N	cyclopentyl	Cl	CF_3	178-181

18	bond	S	N	N	cyclobutyl	Cl	CF_3	185-188
19	bond	S	N	N	cyclopropyl	Cl	CF_3	195-198
20	bond	S	N	N	CF_2Cl	CH_2CH_3	CF_3	123-125
21	bond	S	N	N	CF_2Cl	Cl	CF_3	103-109
22	bond	S	N	N	2-CH_3-cyclopropyl	CH_2CH_3	CF_3	167-170
23	bond	S	N	N	2-CH_3-cyclopropyl	Cl	CF_3	180-182
24	bond	S	N	N	CF_2CF_3	CH_3	CF_3	126-129
25	bond	S	N	N	CF_2CF_3	CH_2CH_3	CF_3	145-147
26	bond	S	N	N	CF_2CF_3	Cl	CF_3	118-120
27	bond	S	N	N	CF_2CF_3	Br	CF_3	94-100 (dec)
28	bond	S	N	N	cyclopentyl	Br	CF_3	181-183
29	bond	S	N	N	cyclobutyl	Br	CF_3	187-190
30	bond	S	N	N	cyclopropyl	Br	CF_3	200-202
31	bond	S	N	N	2-CH_3-cyclopropyl	Br	CF_3	185-187
32	bond	S	N	N	1-CH_3-cyclopropyl	Br	CF_3	165-168
33	bond	S	N	N	CF_2Cl	Br	CF_3	156-159
34	bond	S	N	N	$CH(CH_3)_2$	CH_2CH_3	CF_3	154-157
35	bond	S	N	N	$CH(CH_3)_2$	Cl	CF_3	189-192
36	bond	S	N	N	$CH(CH_3)_2$	Br	CF_3	188-190
37	bond	S	N	N	cyclopropyl	OCH_3	CF_3	189-193
38	bond	S	N	N	$CH(CH_3)_2$	OCH_3	CF_3	173-175
39	bond	S	N	N	CF_2CF_3	OCH_3	CF_3	112-115

INDEX TABLE B



Cmpd No.	T	X	Z	W	V	R^1	R^2	R^4	n	m.p. (°C)
40 Ex. 3	O	bond	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_3	0	99-100
41 Ex. 5	O	bond	CH	N	CH	cyclopropyl	CH_3	CF_3	0	106-107

42	Ex. 6	O	bond	CH	N	CH	$CH_2CH(CH_3)_2$	CH_3	CF_3	0	102-103
43		O	bond	CH	N	CH	2-CH_3-cyclopropyl	CH_3	CF_3	0	122-123
44		O	bond	CH	N	CH	$CH=C(CH_3)_2$	CH_3	CF_3	0	90-91
45		O	O	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_3	0	63-65
46	Ex. 2	O	bond	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_3	1	125-125.5
47		O	bond	CH	N	CH	$CH_2CH(CH_3)_2$	CH_3	CF_3	1	125-125.5
48		O	bond	CH	N	CH	CF_3	CH_3	CF_3	1	158-160
49		O	O	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_3	1	123-123.5
50		O	bond	CH	N	CH	cyclopropyl	CH_3	CF_3	1	145-145.5
51		O	bond	CH	N	CH	$C(CH_3)_3$	CH_3	CF_3	1	122-123
52		O	bond	CH	N	CCH_3	cyclopropyl	CH_3	CF_3	1	137-138
53		O	bond	CH	N	CCH_3	$CH(CH_3)_2$	CH_3	CF_3	1	112-113
54		O	O	CH	N	CCH_3	$CH(CH_3)_2$	CH_3	CF_3	1	101-102
55		O	bond	CH	N	CCH_3	CF_3	CH_3	CF_3	1	120-121
56		O	bond	CH	N	CH	CF_3	Cl	CF_3	1	114-115
57		O	O	CH	N	CH	$CH(CH_3)_2$	Cl	CF_3	1	127-129
58		O	bond	CH	N	CH	$CH(CH_3)_2$	Cl	CF_3	1	132-133
59		O	bond	CH	N	CH	cyclopropyl	Cl	CF_3	1	150-151
60		O	bond	CH	N	CH	$CH(CH_3)_2$	CH_3	Br	1	130-132
61		O	bond	CH	N	CH	cyclopropyl	CH_3	Br	1	126 (dec)
62		O	O	CH	N	CH	$CH(CH_3)_2$	CH_3	Br	1	90 (dec)
63		O	bond	CH	N	CH	CF_3	CH_3	Br	1	188-189
64		O	bond	CH	N	CH	$CH(CH_3)_2$	H	CF_3	1	111-113
65		O	bond	CH	N	CH	cyclopropyl	H	CF_3	1	146-147
66		O	O	CH	N	CH	$CH(CH_3)_2$	H	CF_3	1	143-144
67		O	bond	CH	N	CH	CF_3	H	CF_3	1	102-103
68		O	bond	CH	N	CH	CF_2Cl	CH_3	CF_3	1	136-137
69		O	bond	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_2Cl	1	126-127
70		O	bond	CH	N	CH	CH_2Cl	CH_3	CF_3	1	106-107
71		O	bond	CH	N	CH	$CHCl_2$	CH_3	CF_3	1	108-109
72		O	bond	CH	N	CH	CCl_3	CH_3	CF_3	1	114-115
73		O	bond	CH	N	CH	cyclopropyl	CH_3	CF_2Cl	1	138-139
74		O	bond	CH	N	CH	1-CH_3-cyclopropyl	CH_3	CF_3	1	162-163
75		O	bond	CH	N	CH	cyclobutyl	CH_3	CF_3	1	135-136
76		O	bond	CH	N	CH	$CHClCH_3$	CH_3	CF_3	1	121-122
77		S	bond	CH	N	CH	$CH(CH_3)_2$	CH_3	CF_3	1	117-118

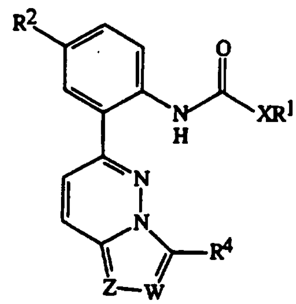
78	O	bond	CH	N	CH	2-CH_3-cyclopropyl	CH_3	CF_3	1	132-134
79	O	bond	CH	N	CH	2,2,3,3-tetra-CH_3-cyclopropyl	CH_3	CF_3	1	161-162
80	O	bond	CH	N	CH	2,2-diCl-1-CH_3-cyclopropyl	CH_3	CF_3	1	oil*
81	O	bond	CH	N	CH	cyclopentyl	CH_3	CF_3	1	128-129
82	O	bond	CH	N	CH	2,4-diF-Ph	CH_3	CF_3	1	96-98
83	O	bond	N	N	CH	$CH(CH_3)_2$	CH_3	Br	1	164-165
84	O	bond	N	N	CH	cyclopropyl	CH_3	Br	1	164-166
85	O	bond	CH	N	CH	4-CH_3-Ph	CH_3	CF_3	1	374**
86	O	bond	CH	N	CH	4-*n*-Pr-Ph	CH_3	CF_3	1	402**
87	O	bond	CH	N	CH	3-NO_2-Ph	CH_3	CF_3	1	405**
88	O	bond	CH	N	CH	$C(CH_3)=CH_2$	CH_3	CF_3	1	324**
89	O	bond	CH	N	CH	$CH=C(CH_3)_2$	CH_3	CF_3	1	338**
90	O	bond	CH	N	CH	$CH=CHCH_3$	CH_3	CF_3	1	324**
91	O	O	CH	N	CH	$CH_2CH(CH_3)_2$	CH_3	CF_3	1	356**
92	O	O	CH	N	CH	CH_2CH_3	CH_3	CF_3	1	328**
93	O	bond	CH	N	CH	2-Cl-Ph	CH_3	CF_3	1	394**
94	O	bond	CH	N	CH	2-F-Ph	CH_3	CF_3	1	378**
95	O	bond	CH	N	CH	2,4-diCl-Ph	CH_3	CF_3	1	428**
96	O	bond	CH	N	CH	2-CH_3O-Ph	CH_3	CF_3	1	390**
97	O	bond	CH	N	CH	2-CF_3-Ph	CH_3	CF_3	1	428**
98	O	bond	CH	N	CH	2-CH_3-Ph	CH_3	CF_3	1	374**
99	O	bond	CH	N	CH	3-Br-Ph	CH_3	CF_3	1	438**
100	O	bond	CH	N	CH	3-Cl-Ph	CH_3	CF_3	1	394**
101	O	bond	CH	N	CH	3,4-diCl-Ph	CH_3	CF_3	1	428**
102	O	bond	CH	N	CH	3-CH_3O-Ph	CH_3	CF_3	1	390**
103	O	bond	CH	N	CH	4-Cl-Ph	CH_3	CF_3	1	394**
104	O	bond	CH	N	CH	4-CH_3O-Ph	CH_3	CF_3	1	390**
105	O	bond	CH	N	CH	4-CH_3CH_2O-Ph	CH_3	CF_3	1	404**
106	O	bond	CH	N	CH	4-*n*-BuO-Ph	CH_3	CF_3	1	432**
107	O	O	CH	N	CH	CH_2CCl_3	CH_3	CF_3	1	430**
108	O	bond	CH	N	CH	4-NO_2-Ph	CH_3	CF_3	1	405**
109	O	bond	CH	N	CH	2,5-diF-Ph	CH_3	CF_3	1	396**
110	O	bond	CH	N	CH	$CH_2CH_2SCH_3$	CH_3	CF_3	1	358**
111	O	bond	CH	N	CH	3-F-Ph	CH_3	CF_3	1	378**

112	O	bond	CH	N	CH	CF_2CF_3	CH_3	CF_3	1	104-106
113	O	bond	CH	N	CH	cyclobutyl	CH_3	CF_2CF_3	1	134
114	O	bond	CH	N	CH	cyclopropyl	CH_3	CF_2CF_3	1	131-133
115	O	bond	CH	N	CH	cyclobutyl	CH_3	CF_2Cl	1	125-127
116	O	bond	CH	N	CH	$CF_2CF_2CF_3$	CH_3	CF_3	1	oil*
117	O	bond	CH	N	CH	CH_3	CH_3	CF_3	1	298**
118	O	NH	CH	N	CH	2,4-diCl-Ph	CH_3	CF_3	1	443**
119	O	NH	CH	N	CH	2-CH_3O-Ph	CH_3	CF_3	1	405**
120	O	NH	CH	N	CH	3-CH_3O-Ph	CH_3	CF_3	1	405**
121	O	NH	CH	N	CH	4-Cl-Ph	CH_3	CF_3	1	409**
122	O	NH	CH	N	CH	4-CH_3-Ph	CH_3	CF_3	1	389**
123	O	NH	CH	N	CH	4-*i*-Pr-Ph	CH_3	CF_3	1	417**
124	O	NH	CH	N	CH	4-*n*-BuO-Ph	CH_3	CF_3	1	447**
125	O	NH	CH	N	CH	cyclohexyl	CH_3	CF_3	1	381**
126	O	NH	CH	N	CH	2-NO_2-Ph	CH_3	CF_3	1	420**
127	O	NH	CH	N	CH	4-NO_2-Ph	CH_3	CF_3	1	420**
128	O	NH	CH	N	CH	2,5-diF-Ph	CH_3	CF_3	1	411**
129	O	NH	CH	N	CH	3-CH_3CH_2-Ph	CH_3	CF_3	1	403**
130	O	bond	CH	N	CH	$CH{=}CH_2$	CH_3	CF_3	1	310**
131	O	bond	CH	N	CH	$CH{=}CHCF_3$	CH_3	CF_3	1	378**
132	O	bond	CH	N	CH	$CCl{=}CCl_2$	CH_3	CF_3	1	412**

* See Index Table D for ^1H NMR data.

** Protonated parent molecular ion (m/e) measured by mass spectrometry using atmospheric pressure chemical ionization in the positive ion mode ($APCI^+$). The ion shown corresponds to the $M+H^+$ ion calculated from the integral values of the atomic weights of the most abundant isotope of each element present.

INDEX TABLE C



Cmpd No.	X	Z	W	R^1	R^2	R^4	m.p.(°C)
133 Ex. 4	bond	N	N	$C(CH_3)_3$	CH_3	CF_3	oil*

*See Index Table D for ^1H NMR data.

INDEX TABLE D

Cmpd No.	^1H NMR Data ($CDCl_3$ solution unless indicated otherwise)[a]
80	δ 1.5 (d,1H), 1.8 (s,3H), 2.3 (s,3H), 2.4 (d,1H), 5.2 (d,1H), 5.3 (d,1H), 6.5-7.7 (m,5H), 9.8 (br s,1H).
116	δ 2.35 (s,3H), 5.2 (s,2H), 6.5-7.8 (m,5H), 11.1 (br s,1H).
133	δ 1.18 (s,9H), 2.42 (s,3H), 7.29 (s,1H), 7.37-7.40 (m,1H), 7.55-7.59 (m,1H), 7.90-7.93 (m,1H), 8.31-8.34 (m,1H), 8.77 (br s,1H).

[a] ^1H NMR data are in ppm downfield from tetramethylsilane. Couplings are designated by (s)-singlet, (d)-doublet, (m)-multiplet, (br s)-broad singlet.

BIOLOGICAL EXAMPLES OF THE INVENTION

TEST A

Seeds of barnyardgrass (*Echinochloa crus-galli*), cocklebur (*Xanthium strumarium*), crabgrass (*Digitaria* spp.), downy brome (*Bromus tectorum*), giant foxtail (*Setaria faberii*), morningglory (*Ipomoea* spp.), sorghum (*Sorghum bicolor*), velvetleaf (*Abutilon theophrasti*), and wild oat (*Avena fatua*) were planted into a sandy loam soil and sprayed preemergence (PRE) or treated by soil drench (PDRN) with test chemicals formulated in a non-phytotoxic solvent mixture which includes a surfactant. At the same time, these crop and weed species were also sprayed postemergence (POST) or sprayed to runoff (STRO) with test chemicals formulated in the same manner.

Plants ranged in height from two to eighteen cm and were in the two to three leaf stage for the postemergence treatment. Treated plants and untreated controls were maintained in a greenhouse for approximately eleven days, after which all treated plants were compared to untreated controls and visually evaluated for injury. Plant response ratings, summarized in Table A, are based on a 0 to 10 scale where 0 is no effect and 10 is complete control. A dash (-) response means no test results.

TABLE A

Rate 2000 g/ha	COMPOUND 85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109
PDRN																									
Barnyardgrass	7	1	2	10	8	10	9	10	4	9	2	0	0	5	0	1	0	6	4	8	0	0	2	3	5
Cocklebur	0	0	0	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crabgrass	10	3	2	10	10	10	10	10	2	7	2	2	1	5	1	2	1	7	2	2	0	0	3	3	3
Downy brome	3	0	0	2	3	7	0	3	0	1	1	0	0	2	0	1	0	2	0	0	0	0	0	1	0
Giant foxtail	10	6	2	10	10	10	10	10	7	10	8	1	2	6	1	2	1	7	7	9	1	0	4	8	7
Morningglory	3	2	1	5	4	10	1	10	1	2	1	0	0	0	1	1	0	1	2	1	0	0	1	1	0
Sorghum	1	1	0	3	3	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Velvetleaf	2	1	0	9	1	9	2	9	1	1	1	0	0	0	1	1	0	0	1	1	0	0	1	1	1
Wild oats	5	0	0	6	4	9	2	9	0	1	0	0	0	1	0	0	0	2	0	2	0	0	0	1	0

TABLE A

Rate 2000 g/ha	COMPOUND 110	111
PDRN		
Barnyardgrass	9	7
Cocklebur	1	0
Crabgrass	10	9
Downy brome	2	2
Giant foxtail	10	10
Morningglory	3	4
Sorghum	2	0
Velvetleaf	3	1
Wild oats	2	4

TABLE A	COMPOUND	
Rate 2000 g/ha	40	133
PRE		
Barnyardgrass	10	10
Cocklebur	2	3
Crabgrass	10	10
Downy brome	10	4
Giant foxtail	9	10
Morningglory	10	10
Sorghum	9	5
Velvetleaf	10	10
Wild oats	10	9

TABLE A	COMPOUND	
Rate 1000 g/ha	40	133
POST		
Barnyardgrass	9	9
Cocklebur	3	6
Crabgrass	9	9
Downy brome	7	0
Giant foxtail	9	9
Morningglory	10	9
Sorghum	8	2
Velvetleaf	3	5
Wild oats	9	4

TABLE A	COMPOUND																							
Rate 1000 g/ha	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109
STRO																									
Barnyardgrass	3	3	3	5	5	6	3	6	4	4	5	1	3	2	3	4	2	3	4	3	1	0	3	4	2
Cocklebur	2	2	0	5	2	4	2	2	2	2	3	0	0	1	1	2	0	2	2	1	0	0	1	2	0
Crabgrass	5	4	3	6	7	6	6	6	4	5	5	2	2	3	3	4	0	4	5	4	1	0	4	5	1
Downy brome	2	0	2	3	2	2	2	0	2	1	1	0	1	1	1	1	0	1	1	1	0	0	1	2	1
Giant foxtail	5	3	2	7	7	7	3	6	4	6	5	0	3	2	3	3	0	3	4	5	1	0	3	5	2
Morningglory	3	3	2	7	5	7	3	2	5	3	4	0	1	3	2	3	0	3	3	2	0	0	4	2	3
Sorghum	2	3	1	2	3	4	2	4	2	2	3	0	2	1	3	3	0	3	3	3	0	0	2	1	1
Velvetleaf	6	4	2	6	6	7	5	4	3	3	3	1	2	2	1	2	0	4	7	3	0	0	3	4	0
Wild oats	2	2	1	3	2	3	2	3	2	2	2	0	1	2	1	2	0	2	3	2	0	0	2	2	1

TABLE A	COMPOUND	
Rate 1000 g/ha	110	111
STRO		
Barnyardgrass	3	4
Cocklebur	2	3
Crabgrass	4	4
Downy brome	1	1
Giant foxtail	4	4
Morningglory	3	4
Sorghum	1	4
Velvetleaf	2	5
Wild oats	2	3

TABLE A	COMPOUND				
Rate 800 g/ha	41	42	43	44	45
PRE					
Barnyardgrass	9	10	9	9	8
Cocklebur	2	0	0	0	0
Crabgrass	10	10	10	10	10
Downy brome	7	3	2	2	1
Giant foxtail	10	10	10	10	10
Morningglory	7	10	1	7	2
Sorghum	7	4	1	1	2
Velvetleaf	10	10	2	5	2
Wild oats	10	7	5	8	3

TABLE A	COMPOUND				
Rate 400 g/ha	41	42	43	44	45
POST					
Barnyardgrass	7	7	3	3	2
Cocklebur	3	1	3	3	3
Crabgrass	8	6	3	5	3
Downy brome	1	1	0	0	0
Giant foxtail	8	5	5	3	2
Morningglory	5	8	7	7	7
Sorghum	2	2	2	2	2
Velvetleaf	2	1	1	2	1
Wild oats	3	2	2	3	1

TEST B

Seeds of barley (*Hordeum vulgare*), barnyardgrass (*Echinochloa crus-galli*), bedstraw (*Galium aparine*), blackgrass (*Alopecurus myosuroides*), chickweed (*Stellaria media*), cocklebur (*Xanthium strumarium*), corn (*Zea mays*), cotton (*Gossypium hirsutum*), crabgrass (*Digitaria sanguinalis*), downy brome (*Bromus tectorum*), giant foxtail (*Setaria faberii*), lambsquarters (*Chenopodium album*), morningglory (*Ipomoea hederacea*), rape (*Brassica napus*), rice (*Oryza sativa*), sorghum (*Sorghum bicolor*), soybean (*Glycine max*), sugar beet (*Beta vulgaris*), velvetleaf (*Abutilon theophrasti*), wheat (*Triticum aestivum*), wild buckwheat (*Polygonum convolvulus*), wild oat (*Avena fatua*) and purple nutsedge (*Cyperus rotundus*) tubers were planted and treated preemergence with test chemicals formulated in a non-phytotoxic solvent mixture which includes a surfactant.

At the same time, these crop and weed species were also treated with postemergence applications of test chemicals formulated in the same manner. Plants ranged in height from two to eighteen cm (one to four leaf stage) for postemergence treatments. Treated plants and controls were maintained in a greenhouse for twelve to sixteen days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table B, are based on a scale of 0 to 10 where 0 is no effect and 10 is complete control. A dash (-) response means no test result.

TABLE B

	COMPOUND																												
Rate 2000 g/ha	2	3	4	5	6	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
POSTEMERGENCE																													
Barley	8	9	9	6	9	9	7	3	3	9	7	8	8	3	4	4	2	7	6	8	8	2	1	0	1	1	0	5	7
Barnyardgrass	8	9	9	9	9	9	9	9	8	9	8	9	9	5	9	7	4	8	9	9	9	4	8	0	2	3	1	9	9
Bedstraw	9	9	9	9	9	9	9	9	8	9	9	9	10	5	9	10	4	9	9	9	9	7	8	2	4	7	4	9	9
Blackgrass	9	9	9	9	9	9	9	9	8	9	9	9	9	2	9	7	2	9	9	9	9	1	8	1	1	1	0	9	9
Chickweed	9	9	9	9	9	9	8	9	7	9	8	9	9	6	9	10	3	9	9	9	9	2	8	2	3	3	1	9	9
Cocklebur	8	1	9	8	8	9	7	9	8	9	7	7	6	3	6	6	5	7	8	3	8	6	3	2	3	1	2	9	8
Corn	7	9	9	7	9	8	7	6	6	9	6	8	8	2	6	2	1	6	7	6	8	2	6	1	1	2	1	6	8
Cotton	9	9	9	10	10	10	9	10	10	10	9	10	10	10	10	10	9	8	10	8	4	8	6	6	6	8	6	10	10
Crabgrass	9	9	9	9	9	9	9	9	7	9	8	9	9	3	9	9	6	9	9	9	9	6	8	1	2	1	2	8	9
Downy brome	8	9	9	8	9	9	8	6	5	9	9	9	9	1	4	4	1	6	7	1	7	0	1	0	0	0	0	8	9
Giant foxtail	9	9	9	9	9	9	9	9	9	9	9	9	9	4	8	9	5	9	9	9	9	7	8	0	4	1	1	9	9
Lambsquarter	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	6	6	7	3	9	9
Morningglory	9	9	10	10	8	10	8	10	9	10	8	9	10	10	9	10	9	8	10	6	9	10	3	3	7	2	3	9	9
Nutsedge	6	9	9	7	8	8	6	6	1	9	3	4	6	1	2	1	1	0	6	4	4	0	1	0	0	0	0	-	-
Rape	9	9	10	9	9	10	10	10	9	10	9	9	9	7	9	10	8	10	9	10	10	9	9	4	8	2	4	10	9
Rice	8	9	9	6	6	9	6	5	5	9	8	9	8	2	4	3	3	4	7	5	8	2	2	0	1	1	0	5	9
Sorghum	8	9	9	5	9	8	3	5	1	8	4	7	7	1	3	2	3	2	5	3	5	1	1	0	0	0	0	7	7
Soybean	8	9	9	9	9	9	9	9	9	9	9	8	9	6	9	7	4	9	9	8	9	8	3	6	8	4	5	9	9
Sugar beet	10	10	10	10	10	10	10	3	9	10	10	10	10	10	10	9	9	10	9	10	9	9	9	5	9	2	3	9	9
Velvetleaf	8	8	8	7	8	9	8	9	8	9	8	8	9	2	9	9	2	8	8	5	8	2	5	2	1	1	1	9	9
Wheat	7	9	9	6	9	8	4	3	3	9	7	4	7	2	3	4	2	5	7	3	7	1	2	0	0	2	0	3	5
Wild buckwheat	8	9	9	10	9	9	6	9	8	9	8	9	8	7	9	10	6	8	9	4	9	8	8	3	8	8	6	9	7
Wild oat	9	9	9	9	9	9	9	8	6	9	8	9	9	1	4	8	1	9	8	7	9	2	5	0	0	0	0	6	8

Rate 2000 g/ha	70	71	72	73	74	75	76	77	79	80	81	82	83	84	112	113	114	115	116	133
POSTEMERGENCE																				
Barley	0	1	5	9	6	8	2	8	0	1	4	2	0	1	1	1	4	8	2	7
Barnyardgrass	1	5	9	9	9	9	9	9	1	3	9	9	2	8	9	6	9	9	4	9
Bedstraw	7	6	7	9	8	8	4	9	0	3	9	8	1	4	8	4	9	9	5	9
Blackgrass	2	0	9	9	9	8	3	9	2	3	8	3	2	1	5	3	9	9	1	8
Chickweed	2	3	8	9	8	6	3	9	0	3	9	5	2	2	9	3	3	8	4	9
Cocklebur	2	4	7	8	4	8	5	6	2	3	7	5	2	2	8	2	6	8	7	5
Corn	1	2	3	9	6	4	5	8	1	2	1	3	1	5	5	1	7	4	2	9
Cotton	6	10	10	10	9	10	8	10	2	10	10	9	3	5	9	5	10	10	8	9
Crabgrass	2	3	6	9	8	9	3	9	1	2	6	3	4	5	8	3	8	9	4	9
Downy brome	1	1	3	9	7	6	1	9	2	1	7	1	0	0	1	2	6	7	0	1
Giant foxtail	1	2	9	9	9	9	4	9	0	2	8	6	6	7	7	7	8	9	3	9
Lambsquarter	4	3	9	9	9	8	4	9	6	7	9	8	2	6	8	8	9	9	9	9
Morningglory	2	3	9	9	8	8	6	9	1	3	6	8	3	4	7	3	7	8	8	9
Nutsedge	-	-	1	-	8	9	3	3	0	0	1	1	-	-	2	0	0	6	0	0
Rape	2	6	9	9	9	9	8	8	5	4	9	10	5	8	9	4	8	10	7	8
Rice	0	1	3	8	7	9	4	7	0	1	7	3	0	0	4	6	7	9	1	8
Sorghum	0	2	4	9	6	7	2	7	0	0	2	2	0	0	3	1	6	7	2	8
Soybean	3	3	8	9	9	6	5	9	7	6	8	5	4	7	9	6	9	8	8	9
Sugar beet	2	4	9	9	9	10	4	8	4	4	7	9	4	6	8	6	10	10	8	7
Velvetleaf	1	7	9	8	7	8	3	9	2	6	6	3	0	3	8	3	8	8	7	6
Wheat	2	0	3	8	3	5	0	8	0	0	3	2	1	1	1	2	4	8	0	6
Wild buckwheat	4	6	6	9	0	2	2	7	2	3	2	3	2	7	3	3	7	1	5	9
Wild oat	0	0	3	9	7	9	1	9	0	1	9	3	2	0	2	4	6	9	0	5

TABLE B

Rate 2000 g/ha	COMPOUND																												
	2	3	4	5	6	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
PREEMERGENCE																													
Barley	5	7	8	3	7	4	4	3	1	9	3	4	5	1	2	5	1	4	3	9	7	0	1	3	2	0	0	4	6
Barnyardgrass	9	10	9	9	10	10	9	10	10	10	10	10	10	6	10	10	6	10	10	10	10	7	9	4	8	4	0	10	10
Bedstraw	8	10	9	10	10	9	10	8	9	9	8	10	9	7	9	10	3	10	10	10	9	7	9	3	10	9	0	9	9
Blackgrass	9	10	10	9	10	10	10	9	10	10	10	10	10	10	10	10	5	10	10	6	10	3	5	2	4	4	0	10	10
Chickweed	9	10	10	9	9	10	10	10	9	10	10	10	9	9	9	9	9	9	10	10	10	8	10	6	8	4	3	10	10
Cocklebur	4	6	8	3	9	6	3	3	1	9	5	4	2	0	5	1	1	3	6	3	8	0	1	0	0	0	0	0	6
Corn	6	10	9	5	9	7	5	6	3	8	3	6	6	1	6	2	1	6	5	6	6	1	4	1	6	2	0	4	8
Cotton	9	10	10	6	10	9	8	9	6	10	5	10	10	2	10	7	6	9	9	4	9	0	6	0	5	5	0	8	10
Crabgrass	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	9	10	7	1	10	10
Downy brome	9	9	8	4	8	7	8	6	4	9	8	7	9	4	9	10	3	4	6	4	7	0	1	2	4	0	2	10	10
Giant foxtail	10	10	10	9	10	10	10	10	10	10	10	9	9	4	10	10	10	10	10	10	10	10	10	9	9	6	2	10	10
Lambsquarter	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	9	9	7	4	10	10
Morningglory	10	10	10	8	10	10	10	10	9	10	9	10	10	6	10	8	7	10	10	10	10	6	7	3	10	5	1	9	10
Nutsedge	10	10	8	6	10	10	6	3	0	9	1	3	8	0	6	1	0	6	10	6	8	0	0	2	7	1	0	-	-
Rape	9	10	10	7	10	10	10	9	9	10	9	10	10	9	9	10	7	10	10	10	10	9	9	3	9	3	0	10	10
Rice	3	8	6	6	8	5	3	3	2	8	5	6	7	1	3	1	0	1	2	4	5	0	2	0	5	1	0	5	9
Sorghum	6	5	7	4	8	4	3	3	1	6	3	6	7	0	2	3	1	3	4	4	5	0	1	0	1	0	0	5	7
Soybean	5	9	10	6	9	10	9	8	5	9	7	8	9	1	5	1	3	8	9	9	9	5	6	5	9	1	0	6	9
Sugar beet	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	7	0	10	10
Velvetleaf	10	10	9	8	10	10	10	10	9	10	9	10	10	4	10	8	9	9	10	10	10	8	10	2	10	1	0	10	10
Wheat	4	7	9	7	7	5	5	2	2	9	4	6	7	0	4	6	0	4	7	7	7	0	1	0	2	0	0	4	8
Wild buckwheat	9	10	10	9	10	6	10	9	9	10	7	10	9	6	9	7	7	9	9	4	10	5	9	2	3	1	0	10	3
Wild oat	9	8	9	8	10	10	9	9	10	10	10	10	10	8	9	9	8	9	10	10	9	2	4	4	4	2	3	9	10

TABLE B

Rate 2000 g/ha	COMPOUND																			
	70	71	72	73	74	75	76	77	79	80	81	82	83	84	112	113	114	115	116	133
PREEMERGENCE																				
Barley	0	0	4	7	2	4	0	8	0	0	2	2	0	4	1	3	5	3	0	7
Barnyardgrass	0	4	9	10	10	10	9	10	2	5	10	9	9	8	10	9	10	10	8	9
Bedstraw	0	3	10	10	10	10	7	9	0	3	9	9	0	3	10	10	10	10	6	10
Blackgrass	0	4	9	10	10	10	3	10	3	3	7	8	3	3	10	9	10	10	6	9
Chickweed	0	1	10	10	9	10	6	10	3	6	10	6	8	8	9	9	7	9	8	9
Cocklebur	0	0	1	9	6	3	1	5	0	0	1	0	0	5	2	0	1	3	0	6
Corn	0	0	4	9	6	1	4	7	0	0	0	1	3	7	4	0	6	2	1	9
Cotton	0	0	10	10	8	9	10	8	0	2	8	3	2	7	9	4	6	8	2	9
Crabgrass	6	7	9	10	10	10	9	10	2	7	10	9	9	9	9	7	10	10	6	10
Downy brome	0	1	10	10	5	3	3	9	0	1	5	1	2	2	8	2	3	9	1	8
Giant foxtail	1	6	10	10	10	10	9	10	3	9	10	10	9	9	9	10	10	10	10	10
Lambsquarter	-	8	10	10	10	10	10	10	6	8	10	10	9	10	10	10	10	10	9	10
Morningglory	0	1	6	10	10	9	7	10	2	1	10	7	0	5	10	2	10	10	1	10
Nutsedge	-	-	0	-	-	5	10	8	0	0	-	-	0	8	4	0	1	6	0	8
Rape	0	8	9	10	10	9	8	10	4	3	8	9	3	10	10	8	10	10	3	10
Rice	0	0	1	10	6	6	6	4	0	0	5	0	2	8	5	1	1	8	0	6
Sorghum	0	0	1	8	4	5	0	5	0	0	2	1	5	2	3	2	2	7	2	5
Soybean	0	0	6	10	9	9	2	9	0	0	7	1	7	9	6	1	9	7	0	9
Sugar beet	0	6	10	10	10	10	6	10	3	8	10	10	10	10	10	10	10	10	10	10
Velvetleaf	0	6	10	10	10	9	7	10	3	9	10	3	0	4	10	9	10	10	7	10
Wheat	0	0	4	9	2	3	1	7	0	0	3	2	2	2	2	1	3	3	0	10
Wild buckwheat	0	1	6	8	0	0	1	5	0	1	0	2	0	3	10	1	10	1	7	9
Wild oat	0	2	9	10	9	10	3	9	0	4	10	8	7	4	9	4	9	10	4	9

TABLE B

Rate 1000 g/ha	COMPOUND																											
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
POSTEMERGENCE																													
Barley	9	6	6	7	4	3	4	9	9	4	4	8	8	2	5	4	7	2	2	9	8	2	4	4	3	3	6	9	7
Barnyardgrass	9	9	9	8	9	8	9	9	9	9	9	9	9	9	10	9	9	10	7	10	10	6	7	8	8	8	9	9	9
Bedstraw	9	8	9	6	9	4	4	9	7	8	8	8	3	7	9	7	7	9	7	10	9	6	7	8	6	8	8	9	9
Blackgrass	9	8	9	9	8	2	6	8	3	6	5	9	8	4	10	7	8	8	3	9	8	5	5	6	4	5	6	9	9
Chickweed	8	5	9	8	9	2	2	8	6	7	3	7	5	7	6	5	6	9	7	9	10	3	7	5	7	9	9	8	6
Cocklebur	2	0	7	5	8	0	0	6	8	7	0	0	8	9	10	7	8	9	9	10	9	0	0	7	4	8	9	5	1
Corn	8	7	9	8	7	6	7	8	8	8	5	7	9	6	6	8	8	7	3	4	4	6	7	6	5	7	3	9	9
Cotton	2	2	9	8	9	8	4	9	9	9	9	9	9	10	10	6	7	10	10	10	9	10	8	8	8	10	10	9	9
Crabgrass	8	8	9	6	8	6	6	9	7	9	6	9	9	9	9	9	9	8	2	10	10	5	7	8	5	6	9	9	7
Downy brome	9	5	5	6	3	1	1	6	1	6	1	4	5	2	2	2	4	2	1	5	4	2	2	3	2	2	3	9	8
Giant foxtail	9	8	9	9	8	8	7	9	9	9	8	9	9	8	9	9	9	8	4	9	8	6	8	8	8	7	10	9	9
Lambsquarter	3	7	7	9	9	5	2	9	7	9	6	6	8	9	10	6	9	9	9	10	9	5	7	8	8	8	9	7	7
Morningglory	3	3	9	8	9	3	3	7	8	8	6	9	8	9	10	6	7	10	4	10	10	3	2	2	2	8	9	8	9
Nutsedge	7	5	-	5	-	0	1	8	2	4	0	7	6	0	2	5	5	1	0	5	1	0	4	4	0	2	3	7	4
Rape	1	1	9	6	8	1	0	8	5	9	3	7	9	6	10	2	8	8	5	10	10	2	3	6	6	9	10	2	9
Rice	6	4	6	7	4	2	2	7	3	6	2	5	7	3	5	8	7	3	1	5	5	1	5	6	4	4	4	8	8
Sorghum	9	7	8	7	4	3	7	8	5	8	6	8	8	3	5	6	6	3	2	6	4	4	6	7	4	5	5	9	8
Soybean	7	3	9	7	9	2	3	8	7	8	5	8	9	2	6	3	8	9	5	8	9	6	6	6	6	9	5	9	9
Sugar beet	8	7	9	9	9	7	7	8	8	9	9	9	9	10	10	10	10	10	10	10	10	7	9	9	9	8	10	9	9
Velvetleaf	7	7	8	7	7	3	2	7	7	7	7	7	9	2	2	3	3	9	8	10	8	2	5	3	5	6	5	8	8
Wheat	9	3	7	7	6	2	2	5	2	3	3	6	7	2	3	5	8	3	2	5	5	2	3	4	3	4	4	9	9
Wild buckwheat	9	9	8	8	9	5	3	6	6	9	5	9	9	9	10	3	7	9	9	10	10	5	8	6	5	9	10	5	8
Wild oat	9	8	10	10	8	6	8	9	8	8	6	9	9	4	10	8	9	6	1	10	9	5	7	8	7	8	8	9	9

TABLE B

Rate 1000 g/ha	COMPOUND																	
	36	37	38	39	40	78	118	119	120	121	122	123	124	125	126	127	128	129
POSTEMERGENCE																		
Barley	9	8	8	3	8	8	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	9	9	9	9	9	9	0	1	0	0	0	0	0	0	0	0	0	0
Bedstraw	8	9	8	8	8	8	0	0	0	0	0	0	0	0	0	0	2	0
Blackgrass	8	9	9	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0
Chickweed	5	9	7	9	9	8	0	0	0	0	0	0	-	-	0	-	-	-
Cocklebur	5	8	0	9	3	6	0	0	0	0	0	0	0	0	0	0	0	0
Corn	8	9	9	8	8	7	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	9	10	10	10	9	10	0	0	1	0	0	1	2	2	2	4	4	2
Crabgrass	9	9	9	9	9	7	0	2	0	0	0	0	0	0	0	0	0	0
Downy brome	6	9	9	5	9	3	0	0	0	0	0	0	0	0	0	0	0	0
Giant foxtail	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0
Lambsquarter	6	9	8	8	8	9	3	0	0	2	0	0	0	2	0	2	1	0
Morningglory	8	9	9	9	5	7	0	0	1	1	0	1	2	2	0	1	3	0
Nutsedge	3	7	7	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Rape	7	8	7	6	9	8	0	0	0	0	0	0	0	1	0	1	1	0
Rice	6	8	8	7	3	8	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	8	9	9	6	6	5	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	9	10	10	9	2	10	0	0	0	0	0	0	2	3	2	0	4	0
Sugar beet	9	9	8	9	8	7	0	0	0	0	0	0	0	3	2	2	3	0
Velvetleaf	6	7	8	9	5	9	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	8	9	8	6	8	7	0	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	8	9	8	9	8	3	0	0	0	0	0	0	0	0	0	0	1	0
Wild oat	9	9	9	7	9	8	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B

	COMPOUND																												
Rate 1000 g/ha	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
PREEMERGENCE																													
Barley	7	6	3	7	2	0	0	4	2	2	2	5	2	0	1	2	4	2	1	4	3	3	3	2	4	3	2	3	3
Barnyardgrass	9	9	9	9	9	3	6	9	9	8	8	9	9	9	8	9	9	10	9	10	9	8	9	9	8	9	9	10	10
Bedstraw	10	10	9	10	10	8	9	10	7	8	9	9	9	10	8	10	10	9	5	9	10	10	10	10	9	9	6	9	10
Blackgrass	10	9	10	10	9	6	6	8	5	8	6	9	9	3	3	8	5	10	8	9	9	6	6	9	4	8	4	9	10
Chickweed	10	9	10	9	9	9	9	9	8	8	9	9	10	9	9	9	10	9	9	9	9	8	9	10	9	9	7	9	9
Cocklebur	0	3	8	3	6	0	1	5	0	4	0	0	8	5	0	6	4	1	2	6	2	0	0	4	1	4	0	0	2
Corn	8	7	9	6	5	3	4	6	4	7	5	7	7	5	3	6	8	6	1	4	3	5	6	8	4	7	2	8	8
Cotton	4	3	3	2	3	2	1	2	1	6	4	4	4	4	0	2	9	1	2	0	1	0	0	3	0	0	1	10	6
Crabgrass	10	10	10	10	10	9	10	10	10	10	9	10	10	8	9	10	10	10	10	10	10	10	10	10	10	10	8	10	10
Downy brome	4	4	9	4	3	3	1	5	3	6	4	3	4	2	3	2	7	2	3	5	3	3	3	4	2	3	7	9	7
Giant foxtail	10	10	10	10	10	9	8	10	10	10	10	10	10	8	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10
Lambsquarter	10	10	10	10	10	9	2	10	9	10	8	9	10	10	10	10	10	10	9	10	10	10	10	10	9	10	9	9	10
Morningglory	7	7	10	9	6	3	9	10	5	10	7	10	10	1	3	6	10	5	9	10	8	4	7	10	9	9	7	9	10
Nutsedge	8	10	-	2	7	0	1	6	6	8	0	5	6	0	0	4	5	0	0	0	0	0	0	2	0	1	0	8	8
Rape	1	2	9	9	2	0	0	7	2	10	5	4	10	2	9	8	10	1	3	10	10	4	3	10	10	10	7	8	10
Rice	4	2	5	6	2	0	1	4	2	4	0	2	5	0	0	6	5	5	0	2	0	0	0	5	2	4	2	5	3
Sorghum	7	5	7	6	0	0	6	7	3	4	4	5	7	4	4	7	8	3	0	8	6	8	8	7	7	8	2	8	10
Soybean	8	6	8	2	3	0	3	8	4	8	7	6	9	3	3	5	8	6	1	8	8	6	6	9	5	7	0	9	9
Sugar beet	10	10	10	10	9	6	8	10	10	10	10	10	10	10	8	10	10	10	10	10	10	9	9	10	10	9	7	9	10
Velvetleaf	10	9	10	10	3	7	6	10	6	10	7	8	8	3	0	9	9	10	10	8	6	5	7	8	6	6	0	10	10
Wheat	8	8	5	9	4	1	0	5	2	1	2	3	1	0	2	0	2	4	1	3	4	3	4	3	3	4	3	4	4
Wild buckwheat	9	1	10	6	7	4	4	10	7	10	6	3	10	6	8	3	2	9	7	9	5	3	2	9	2	6	4	8	10
Wild oat	9	9	10	10	7	2	3	6	4	6	3	4	7	3	7	6	6	5	2	10	9	5	7	7	5	9	6	10	7

TABLE B

Rate 1000 g/ha	COMPOUND																	
	36	37	38	39	40	78	118	119	120	121	122	123	124	125	126	127	128	129
PREEMERGENCE																		
Barley	5	4	6	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	9	10	9	9	9	10	0	0	0	0	0	0	0	0	0	0	0	0
Bedstraw	9	9	10	8	8	9	0	0	0	0	0	0	0	-	0	0	0	0
Blackgrass	7	10	9	9	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Chickweed	9	10	10	9	10	9	0	0	0	0	0	0	0	0	0	0	0	0
Cocklebur	1	8	0	5	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Corn	7	10	10	8	5	7	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	6	9	10	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Crabgrass	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Downy brome	4	5	5	4	9	4	0	0	0	0	0	0	0	0	0	0	0	0
Giant foxtail	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Lambsquarter	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Morningglory	10	10	10	10	6	10	0	0	0	0	0	0	0	0	0	0	0	0
Nutsedge	4	6	8	2	8	6	0	0	0	0	-	0	0	0	0	0	0	0
Rape	9	10	9	6	9	9	0	0	0	0	0	0	0	0	0	0	0	0
Rice	4	2	8	2	3	4	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	7	10	10	4	6	5	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	8	10	9	6	1	8	0	0	0	0	0	0	0	0	0	0	0	0
Sugar beet	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Velvetleaf	8	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	5	5	5	2	5	4	0	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	9	9	10	10	7	2	0	0	0	0	0	0	0	0	0	0	0	0
Wild oat	8	7	4	6	10	8	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B

Rate 400 g/ha	COMPOUND																												
POSTEMERGENCE	1	2	3	4	5	6	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
Barley	8	6	9	8	3	8	4	0	1	1	0	7	5	2	1	7	2	6	5	2	1	2	2	2	3	1	1	1	1
Barnyardgrass	9	7	9	8	9	9	8	4	3	3	3	9	7	8	3	9	5	9	9	2	7	4	2	6	8	3	8	2	5
Bedstraw	8	9	9	9	9	9	7	5	3	2	2	9	9	9	4	9	7	8	9	6	9	8	4	7	8	6	8	5	5
Blackgrass	9	5	9	9	9	9	3	2	2	3	1	9	5	7	3	9	4	8	9	1	6	3	2	4	5	2	3	1	4
Chickweed	8	8	9	9	9	9	5	3	2	2	1	9	8	8	6	9	5	7	9	3	9	9	3	7	8	3	2	2	3
Cocklebur	6	6	0	5	5	3	3	2	5	2	3	7	5	5	3	8	4	3	4	3	5	2	4	5	6	3	6	3	2
Corn	8	6	9	8	6	7	7	4	2	3	2	4	1	3	2	7	4	6	4	2	1	1	1	3	3	1	2	1	2
Cotton	4	8	3	8	10	9	0	0	0	0	0	6	6	10	4	10	9	9	9	9	10	9	5	8	10	5	5	7	7
Crabgrass	9	9	9	9	9	8	8	6	5	7	2	9	7	9	4	9	3	8	8	2	7	6	2	4	4	4	7	1	4
Downy brome	7	4	9	7	5	4	2	1	1	0	0	6	2	2	1	8	2	2	5	1	1	2	1	1	3	1	1	0	1
Giant foxtail	9	9	9	9	9	9	7	5	4	6	2	9	8	9	3	9	7	8	8	2	5	6	2	8	5	6	8	1	4
Lambsquarter	8	9	9	9	9	9	3	3	2	2	1	9	9	9	9	9	9	9	9	8	9	9	7	9	9	8	9	6	8
Morningglory	8	8	9	9	10	6	2	6	3	6	3	9	8	10	9	9	9	10	9	6	10	6	2	9	9	9	9	9	3
Nutsedge	7	2	8	3	4	6	3	-	1	-	-	3	3	1	0	5	0	3	3	0	0	0	0	0	1	0	1	0	0
Rape	3	8	9	7	8	9	5	2	3	4	3	9	9	9	8	9	7	9	9	7	9	10	6	9	9	8	8	5	7
Rice	8	4	9	9	5	8	0	0	2	2	0	8	3	2	1	8	3	6	6	1	2	2	1	2	2	2	3	1	1
Sorghum	8	4	8	8	3	7	1	1	1	1	1	2	2	2	2	6	1	2	2	1	1	2	1	2	1	1	2	1	0
Soybean	3	6	6	9	8	8	2	2	3	3	3	9	9	9	9	9	8	7	9	6	6	6	4	8	8	8	8	7	2
Sugar beet	8	10	9	8	9	9	6	0	3	3	3	9	9	9	7	10	8	10	10	9	9	9	9	9	9	8	8	9	9
Velvetleaf	4	6	6	4	2	4	7	6	6	6	3	6	3	8	2	8	5	5	7	2	7	3	2	2	2	2	3	2	1
Wheat	8	5	9	9	2	4	3	2	1	1	0	4	2	2	1	8	2	3	3	2	1	3	1	3	3	1	2	1	1
Wild buckwheat	8	7	9	9	9	8	2	2	2	1	0	6	4	9	5	9	5	7	7	3	8	9	4	7	7	1	6	2	1
Wild oat	9	8	9	9	4	8	7	2	2	2	0	8	3	2	0	9	0	5	6	0	1	1	1	5	3	1	2	0	1

TABLE B

Rate 400 g/ha	COMPOUND 64	65	66	67	68	69	70	71	72	73	74	75	76	77	79	80	81	82	83	84	85	88	89	90	91	92	94	104
POSTEMERGENCE																												
Barley	0	0	0	0	4	5	0	0	4	7	3	7	0	4	0	1	2	1	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	0	0	0	0	9	9	0	3	4	9	7	9	3	9	2	2	6	4	0	1	3	1	1	6	2	5	3	3
Bedstraw	2	6	2	3	9	8	7	3	7	9	5	8	3	9	0	3	8	6	1	2	2	4	3	4	2	2	3	3
Blackgrass	0	0	0	0	6	8	0	1	2	9	4	6	1	8	1	2	3	2	2	2	1	3	0	3	0	3	2	2
Chickweed	1	2	1	0	8	7	2	3	6	8	3	3	2	6	0	2	4	4	2	2	1	2	1	3	0	2	0	2
Cocklebur	1	2	0	0	5	4	0	5	3	7	5	5	5	4	1	2	5	3	0	2	2	3	2	6	2	1	3	3
Corn	0	0	0	0	5	6	0	1	1	7	2	2	2	7	1	1	1	2	0	0	2	1	1	6	1	4	2	2
Cotton	3	5	5	1	10	9	2	7	10	10	-	8	8	10	1	9	9	9	0	3	3	4	3	9	3	4	6	3
Crabgrass	1	0	0	1	7	8	0	2	3	9	3	6	2	4	1	2	2	2	1	2	1	2	2	4	5	3	6	2
Downy brome	0	0	0	0	3	2	0	2	1	4	0	1	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Giant foxtail	0	0	0	0	6	8	0	2	3	9	5	7	3	5	1	2	4	2	0	0	2	1	2	5	5	4	3	2
Lambsquarter	5	5	5	2	8	9	1	3	8	9	8	6	3	9	3	4	8	7	3	5	4	5	5	9	8	8	7	8
Morningglory	2	2	2	2	9	9	1	2	3	9	3	4	3	7	2	2	2	2	1	3	3	5	2	8	2	2	6	3
Nutsedge	0	0	0	0	-	0	0	-	1	-	0	3	1	1	0	0	0	1	-	-	0	1	0	3	0	0	0	0
Rape	1	2	2	2	9	8	0	6	8	9	5	8	4	8	2	3	6	9	2	3	3	3	1	6	6	4	3	3
Rice	0	0	0	0	3	4	0	1	1	8	3	6	2	4	0	1	3	0	0	0	1	1	0	3	1	2	1	1
Sorghum	0	0	0	0	3	2	0	1	1	6	0	3	0	1	0	0	1	1	0	0	2	1	0	1	1	1	2	2
Soybean	4	6	2	2	9	8	1	3	7	9	8	6	4	9	5	7	8	2	2	5	6	8	7	9	4	8	7	8
Sugar beet	2	2	1	2	9	8	0	3	9	9	8	10	2	6	3	2	6	8	2	3	8	6	3	5	8	4	5	6
Velvetleaf	1	2	1	1	-	4	0	6	8	8	3	4	3	8	1	3	4	3	0	0	2	2	2	4	2	2	3	2
Wheat	0	0	1	0	3	3	0	0	3	4	1	2	0	3	0	0	1	1	0	1	0	0	0	2	3	0	0	2
Wild buckwheat	1	3	3	4	6	2	3	4	6	9	0	1	2	4	0	2	2	2	1	3	3	1	0	3	3	0	0	3
Wild oat	0	0	0	0	3	2	0	0	3	6	1	5	1	2	0	1	3	1	1	0	0	2	0	0	2	0	0	0

TABLE B

Rate 400 g/ha	COMPOUND											
	110	111	112	113	114	115	116	117	130	131	132	133
POSTEMERGENCE												
Barley	0	0	0	0	1	7	0	0	0	0	0	0
Barnyardgrass	0	2	5	4	7	9	2	0	4	0	0	1
Bedstraw	1	4	5	3	8	7	5	1	6	5	1	7
Blackgrass	2	1	2	2	2	9	0	0	2	0	0	3
Chickweed	0	7	3	2	3	3	3	0	2	2	0	6
Cocklebur	1	4	4	1	3	4	3	0	7	7	6	5
Corn	0	2	3	1	4	1	1	0	2	0	0	2
Cotton	4	10	9	5	6	7	7	4	10	9	2	9
Crabgrass	2	2	2	2	3	6	2	0	2	0	0	3
Downy brome	0	2	0	2	1	2	0	0	0	0	0	1
Giant foxtail	1	1	3	5	7	8	2	0	4	0	0	3
Lambsquarter	4	5	5	8	8	9	6	0	-	7	4	8
Morningglory	2	6	7	1	1	7	1	2	5	3	2	8
Nutsedge	0	-	0	0	0	1	0	0	0	0	0	0
Rape	0	7	8	4	6	8	5	0	6	2	0	6
Rice	0	1	0	2	3	8	0	0	3	1	1	2
Sorghum	0	0	3	1	1	3	1	0	0	0	0	1
Soybean	3	4	7	5	9	8	5	2	7	4	2	8
Sugar beet	3	9	6	6	9	9	5	2	6	5	3	6
Velvetleaf	0	5	2	6	6	8	-	4	1	2	0	5
Wheat	0	2	0	1	0	3	0	0	0	0	0	0
Wild buckwheat	2	3	2	2	6	2	3	0	3	3	1	6
Wild oat	0	2	0	1	1	6	0	0	0	0	0	1

TABLE B

Rate 400 g/ha	COMPOUND 1	2	3	4	5	6	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
PREEMERGENCE																													
Barley	8	1	3	4	1	4	2	0	0	0	0	4	0	0	0	5	2	2	2	0	3	0	0	4	2	3	5	0	0
Barnyardgrass	9	8	10	8	9	7	9	10	4	9	8	10	8	9	7	9	6	10	10	1	9	3	1	8	9	6	10	0	9
Bedstraw	10	7	10	9	9	10	9	9	1	-	0	8	3	8	7	9	5	10	9	1	9	8	-	9	10	7	9	-	8
Blackgrass	9	9	10	9	7	9	8	8	3	4	1	10	5	8	5	10	8	8	8	1	6	5	2	3	6	6	7	1	3
Chickweed	9	10	10	10	9	9	9	8	7	2	0	9	8	9	7	9	6	8	8	4	9	9	5	9	9	8	9	-	10
Cocklebur	2	1	0	6	1	7	1	0	0	0	0	2	0	0	0	5	1	1	0	0	0	0	0	0	2	0	3	0	0
Corn	7	3	8	7	4	7	5	3	2	4	1	5	2	1	1	7	2	4	6	0	1	1	0	2	2	4	3	0	0
Cotton	4	3	3	1	2	3	0	0	0	0	0	4	2	7	1	7	1	1	3	0	3	2	0	1	3	0	2	0	0
Crabgrass	10	10	10	10	9	9	10	10	9	10	9	10	6	9	10	10	9	10	10	2	8	8	6	10	10	10	10	8	10
Downy brome	5	4	7	5	2	8	2	1	0	1	2	2	2	4	2	3	2	4	5	0	3	3	0	1	3	4	3	0	1
Giant foxtail	10	10	10	10	8	9	10	10	10	10	9	10	9	10	9	10	5	7	7	2	6	10	7	10	10	8	9	4	10
Lambsquarter	10	10	10	10	10	10	9	9	10	8	6	10	10	10	10	10	9	10	10	9	10	10	7	10	10	10	10	-	10
Morningglory	7	9	10	8	3	7	2	3	0	1	0	10	9	5	2	9	2	9	9	3	6	7	3	6	10	4	10	2	6
Nutsedge	-	3	9	0	-	7	10	0	0	0	0	7	0	0	0	3	0	3	4	0	0	0	0	0	0	3	0	0	0
Rape	6	10	6	9	7	7	6	2	0	2	0	9	9	9	3	9	3	9	9	7	9	7	2	9	10	3	9	-	9
Rice	7	2	8	4	4	6	0	0	0	0	0	4	1	1	1	6	1	6	6	0	1	0	0	0	0	0	1	0	0
Sorghum	6	3	6	4	2	6	4	0	0	0	0	2	0	1	0	2	0	4	3	0	1	0	0	0	0	0	1	0	0
Soybean	8	4	9	9	6	9	0	1	0	0	0	8	5	3	5	9	4	7	7	0	3	0	0	6	8	7	8	0	2
Sugar beet	10	9	9	10	9	10	10	3	6	7	3	10	9	10	9	10	10	10	10	9	9	9	8	9	10	9	10	5	10
Velvetleaf	10	9	10	10	7	9	3	2	0	0	1	10	10	10	9	10	6	10	9	1	10	8	3	10	10	10	10	2	9
Wheat	8	2	6	5	3	7	3	1	0	0	0	5	0	0	1	6	1	3	3	0	1	0	0	3	3	0	6	0	0
Wild buckwheat	7	7	9	9	6	10	9	1	0	0	0	2	1	9	2	7	1	2	3	0	9	-	3	8	8	4	6	-	3
Wild oat	8	6	8	9	4	10	9	8	6	8	5	9	4	5	3	9	4	10	9	3	4	2	1	4	7	4	7	0	3

TABLE B

Rate 400 g/ha	COMPOUND																											
	64	65	66	67	68	69	70	71	72	73	74	75	76	77	79	80	81	82	83	84	85	88	89	90	91	92	94	104
PREEMERGENCE																												
Barley	0	0	0	0	0	4	0	0	1	3	0	1	0	7	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Barnyardgrass	0	3	0	0	10	10	0	0	5	10	8	9	6	9	0	0	7	5	4	0	2	7	1	8	1	8	3	6
Bedstraw	-	0	-	0	9	9	0	2	9	10	9	9	1	7	0	0	8	6	0	0	1	1	0	7	0	1	0	3
Blackgrass	2	4	2	0	9	9	0	0	4	9	9	3	2	9	0	0	4	2	2	2	0	2	0	6	1	4	1	1
Chickweed	3	5	1	0	9	9	0	0	9	9	9	5	0	9	0	0	5	1	0	6	6	0	6	7	3	1	0	6
Cocklebur	0	0	0	0	0	2	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corn	0	0	0	0	3	4	0	0	1	7	3	0	0	6	0	0	0	0	0	3	0	0	0	2	0	4	0	0
Cotton	0	1	0	0	8	3	0	0	8	10	1	6	0	4	0	0	3	1	0	0	0	0	0	5	0	0	0	0
Crabgrass	0	6	0	0	10	10	0	0	5	10	9	9	2	10	1	0	8	2	7	5	6	8	6	10	3	9	2	1
Downy brome	0	4	0	0	4	3	0	0	4	4	3	1	0	3	0	0	2	1	0	0	0	0	0	0	3	0	0	1
Giant foxtail	0	1	2	0	10	10	0	1	9	10	10	10	7	10	1	2	9	9	1	3	7	9	4	9	6	9	8	8
Lambsquarter	4	7	0	0	10	10	0	4	10	10	10	10	9	9	0	0	8	9	9	8	3	9	3	9	3	9	8	5
Morningglory	0	3	0	0	5	9	0	0	4	10	3	3	1	9	0	0	6	1	0	2	1	2	0	2	0	3	1	0
Nutsedge	0	0	0	0	0	8	0	0	-	-	0	0	0	8	0	0	-	-	0	0	0	0	-	-	-	-	-	0
Rape	3	2	0	0	9	9	0	0	7	9	8	7	4	9	0	0	9	4	0	2	2	0	0	4	3	4	0	4
Rice	0	0	0	0	1	7	0	0	0	7	4	3	0	4	0	0	3	0	0	0	0	0	0	1	0	2	0	0
Sorghum	0	0	0	0	1	4	0	0	0	6	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	1	3	0	0	3	9	0	0	1	9	5	6	0	9	0	0	3	0	4	6	0	1	0	5	0	3	0	0
Sugar beet	1	3	0	0	10	9	0	0	9	10	10	10	5	10	1	1	9	8	2	6	6	8	5	7	6	8	3	6
Velvetleaf	0	2	0	0	8	10	0	0	7	10	10	9	-	6	0	1	8	0	0	0	2	2	0	2	0	2	0	1
Wheat	2	2	0	0	1	5	0	0	1	4	0	0	0	6	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Wild buckwheat	0	1	0	0	10	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
Wild oat	3	2	0	0	9	9	0	0	9	10	8	10	0	9	0	0	5	3	2	0	0	3	0	2	0	3	1	2

TABLE B

Rate 400 g/ha	COMPOUND											
	110	111	112	113	114	115	116	117	130	131	132	133
PREEMERGENCE												
Barley	0	0	0	0	0	5	0	0	0	0	0	2
Barnyardgrass	0	1	9	6	9	9	0	1	6	0	0	6
Bedstraw	0	0	7	8	10	9	1	0	3	0	0	2
Blackgrass	0	2	10	8	5	9	1	0	6	0	0	3
Chickweed	0	1	7	1	5	7	5	0	0	0	0	6
Cocklebur	0	0	0	0	0	0	0	0	0	0	0	1
Corn	0	0	3	0	2	0	0	1	2	0	0	6
Cotton	1	2	2	1	4	6	0	0	4	0	0	2
Crabgrass	3	1	7	2	6	10	1	3	9	0	0	9
Downy brome	0	1	1	2	2	3	0	0	2	0	0	2
Giant foxtail	1	3	10	9	10	10	6	2	8	0	0	9
Lambsquarter	7	6	10	9	9	10	2	0	-	3	0	9
Morningglory	1	1	6	-	2	6	1	0	9	2	0	6
Nutsedge	0	0	-	0	0	0	0	0	0	0	0	-
Rape	0	2	10	4	9	9	0	0	7	0	0	7
Rice	1	0	1	0	1	5	0	0	3	0	0	3
Sorghum	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	2	0	2	0	5	4	0	0	2	0	0	7
Sugar beet	0	9	10	9	10	9	4	0	8	2	0	9
Velvetleaf	0	0	10	2	4	10	2	0	1	0	0	5
Wheat	0	0	0	0	0	2	0	0	1	0	0	3
Wild buckwheat	0	0	10	2	5	0	1	0	3	2	0	4
Wild oat	0	1	6	4	3	5	0	0	4	0	0	7

TABLE B

Rate 200 g/ha	COMPOUND 7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
POSTEMERGENCE																													
Barley	4	3	6	4	1	1	3	5	1	2	0	3	2	0	2	0	2	2	1	7	5	2	2	3	2	2	4	8	7
Barnyardgrass	9	7	8	7	6	5	7	9	7	8	5	8	9	6	7	7	8	7	2	9	6	3	5	5	2	4	7	8	9
Bedstraw	7	5	7	6	9	3	3	4	4	5	6	4	-	4	6	3	3	9	8	9	9	6	7	8	6	7	8	9	6
Blackgrass	8	2	4	6	5	1	3	5	2	2	1	2	3	1	2	1	3	3	2	4	3	2	3	4	3	2	4	4	7
Chickweed	7	3	4	4	4	0	2	3	3	4	-	4	3	3	4	3	2	8	5	8	7	4	6	4	5	6	9	3	5
Cocklebur	1	0	3	2	5	0	0	3	7	7	0	0	7	3	5	6	5	8	8	9	9	0	0	4	-	6	7	0	0
Corn	7	5	8	7	5	3	4	8	3	4	3	5	8	4	2	5	6	4	2	2	3	2	3	5	2	2	3	6	7
Cotton	2	0	9	8	8	4	4	9	9	7	8	9	9	10	10	6	6	10	9	6	9	7	7	3	8	7	10	10	7
Crabgrass	6	6	5	3	4	3	3	8	8	7	6	3	6	4	3	6	8	2	1	2	2	2	4	4	2	2	5	4	6
Downy brome	3	1	2	1	2	0	0	1	1	1	1	1	1	1	1	0	1	1	1	3	3	1	1	2	1	1	3	2	6
Giant foxtail	8	6	7	6	5	5	6	7	6	6	4	7	8	4	7	7	8	4	2	3	3	4	5	6	3	3	8	9	9
Lambsquarter	3	5	6	8	9	1	2	6	7	6	6	3	7	9	9	6	7	9	9	9	9	4	5	8	7	7	8	5	6
Morningglory	2	2	7	3	5	3	3	3	8	8	8	5	8	8	10	3	5	8	8	9	9	2	2	2	2	2	8	2	8
Nutsedge	3	1	2	-	1	0	0	2	0	2	0	3	3	0	1	3	2	1	0	0	1	0	0	0	0	0	2	1	0
Rape	0	0	5	3	6	0	0	3	2	8	1	1	9	3	8	1	5	7	5	10	10	2	4	6	6	7	10	2	6
Rice	4	0	3	4	2	0	0	2	3	3	2	1	4	1	4	5	6	1	1	2	3	0	1	1	1	1	3	5	5
Sorghum	7	2	6	4	2	0	1	5	1	3	2	5	5	2	2	1	2	2	2	3	2	2	2	2	2	2	3	3	6
Soybean	6	3	9	6	7	2	2	7	6	6	4	6	9	1	1	2	8	8	3	8	9	6	5	6	6	7	2	9	9
Sugar beet	7	6	8	8	6	6	6	8	7	7	8	9	9	10	6	9	10	9	9	10	10	7	8	8	9	8	9	9	8
Velvetleaf	3	4	5	2	2	2	2	5	7	6	7	6	7	3	2	3	2	8	8	3	7	1	2	1	1	2	2	6	6
Wheat	5	3	4	4	2	0	1	2	0	1	0	1	3	1	2	0	1	1	1	3	3	2	1	3	2	1	3	4	7
Wild buckwheat	3	4	7	5	9	3	3	6	4	5	5	6	8	6	8	1	1	8	7	9	9	3	5	6	5	8	8	5	8
Wild oat	8	4	7	9	5	3	5	8	3	4	1	5	5	1	3	4	7	1	1	3	4	3	3	4	4	2	3	8	8

TABLE B

Rate 200 g/ha	COMPOUND																	
POSTEMERGENCE	36	37	38	39	40	78	118	119	120	121	122	123	124	125	126	127	128	129
Barley	5	4	4	2	7	2	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	5	9	7	7	9	8	0	0	0	0	0	0	0	0	0	0	0	0
Bedstraw	5	8	8	8	6	6	0	0	0	0	0	0	0	0	0	0	0	0
Blackgrass	5	7	8	6	8	6	0	0	0	0	0	0	0	0	0	0	0	0
Chickweed	3	8	5	7	7	6	0	0	0	0	0	0	0	0	0	-	0	0
Cocklebur	0	3	0	8	0	4	0	0	0	0	0	0	0	0	0	0	0	0
Corn	4	8	9	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	8	10	9	10	2	9	0	0	0	0	0	0	1	1	0	0	1	0
Crabgrass	5	8	8	9	9	2	0	0	0	0	0	0	0	0	0	0	0	0
Downy brome	2	3	2	3	7	2	0	0	0	0	0	0	0	0	0	0	0	0
Giant foxtail	8	9	9	9	9	2	0	0	0	0	0	0	0	0	0	0	0	0
Lambsquarter	6	7	7	7	6	8	0	0	0	0	0	0	0	0	0	0	0	0
Morningglory	8	8	9	9	1	2	0	0	0	0	0	0	1	0	0	0	0	0
Nutsedge	0	1	3	3	-	0	0	0	0	0	0	0	0	0	0	0	0	0
Rape	2	8	3	5	6	7	0	0	0	0	0	0	0	0	0	0	0	0
Rice	4	5	8	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	3	6	8	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	8	9	9	9	0	7	0	0	0	0	0	0	2	3	0	0	3	0
Sugar beet	8	6	6	9	6	5	0	0	0	0	0	0	0	1	0	0	0	0
Velvetleaf	1	6	5	9	5	5	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	6	6	6	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	6	7	8	8	7	2	0	0	0	0	0	0	0	0	0	0	0	0
Wild oat	6	7	8	5	4	2	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B

Rate 200 g/ha	COMPOUND																											
PREEMERGENCE	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Barley	4	3	4	3	1	0	0	1	2	0	0	1	1	0	0	2	0	0	0	1	1	0	1	1	0	2	1	4	3
Barnyardgrass	9	7	6	8	7	1	4	6	4	3	4	7	6	5	3	9	7	9	7	8	6	8	8	8	5	7	6	8	8
Bedstraw	9	10	9	9	4	2	3	9	5	5	3	2	6	5	3	7	9	8	2	3	2	2	3	3	4	4	3	9	10
Blackgrass	6	7	9	9	4	2	2	6	3	3	3	4	5	1	1	2	2	9	3	7	3	4	3	3	3	3	0	5	5
Chickweed	9	8	9	7	7	3	7	8	7	6	7	8	8	6	6	8	7	9	6	8	4	6	7	8	6	8	6	9	9
Cocklebur	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Corn	6	6	5	4	2	0	0	4	0	5	0	2	1	2	0	5	7	3	1	2	0	3	2	4	2	3	0	6	6
Cotton	3	1	0	2	2	0	1	2	0	0	0	0	-	0	0	1	1	1	2	-	0	0	-	1	-	0	0	2	0
Crabgrass	10	10	10	10	7	8	8	9	8	9	8	9	9	4	4	9	9	10	8	10	9	9	10	10	8	10	7	10	10
Downy brome	3	2	3	4	2	0	0	2	1	2	2	2	1	2	1	1	1	2	1	2	2	2	0	3	2	2	2	3	3
Giant foxtail	10	10	10	10	7	7	5	7	7	8	8	9	9	2	5	7	8	9	4	9	8	9	9	9	9	9	7	10	10
Lambsquarter	10	10	10	10	9	5	0	10	9	10	7	10	9	10	10	10	10	9	9	10	9	6	9	10	9	9	9	9	9
Morningglory	2	2	5	6	3	2	0	1	1	6	3	3	5	1	0	0	5	-	3	6	3	1	-	5	3	1	2	5	10
Nutsedge	9	1	3	-	0	0	-	-	6	0	0	2	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	1
Rape	0	0	3	7	0	0	0	0	1	5	2	1	9	0	4	0	9	0	1	9	6	2	0	6	5	3	4	0	9
Rice	4	1	0	3	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	1	0	0	0	1	0	1	0	0	2
Sorghum	5	3	3	4	0	0	2	3	0	0	0	2	0	2	0	5	3	0	0	4	2	3	2	3	2	6	0	6	7
Soybean	5	4	6	6	1	0	0	4	0	5	4	4	7	0	0	1	5	1	0	2	2	2	4	7	3	4	0	6	9
Sugar beet	10	10	10	10	9	3	5	9	9	10	7	9	10	7	3	9	10	9	8	9	9	6	8	9	9	7	2	9	10
Velvetleaf	6	4	10	8	2	3	2	2	3	2	4	2	3	1	0	0	6	10	5	4	2	0	2	3	1	1	0	7	7
Wheat	7	2	3	4	2	1	0	1	0	0	0	1	-	0	0	1	1	1	1	1	1	1	1	3	0	2	0	4	3
Wild buckwheat	6	0	4	3	4	0	1	3	0	6	3	2	7	2	2	1	0	4	3	3	2	2	0	2	2	1	2	7	10
Wild oat	9	4	10	8	3	1	2	3	2	1	3	2	4	0	1	3	1	4	0	8	5	3	4	4	3	4	1	6	4

TABLE B

Rate 200 g/ha	COMPOUND																	
	36	37	38	39	40	78	118	119	120	121	122	123	124	125	126	127	128	129
PREEMERGENCE																		
Barley	3	2	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	7	6	9	9	8	8	0	0	0	0	0	0	0	0	0	0	0	0
Bedstraw	9	7	8	8	4	7	0	0	0	0	0	0	0	0	0	0	0	0
Blackgrass	6	5	6	7	9	5	0	0	0	0	0	0	0	0	0	0	0	0
Chickweed	8	9	9	9	9	5	0	0	0	0	0	0	0	0	0	0	0	0
Cocklebur	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corn	4	7	8	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	3	3	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crabgrass	10	10	10	10	10	9	0	0	0	0	0	0	0	0	0	0	0	0
Downy brome	3	3	5	3	7	1	0	0	0	0	0	0	0	0	0	0	0	0
Giant foxtail	9	10	10	9	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Lambsquarter	9	10	10	10	9	10	0	0	0	0	0	0	0	0	0	0	0	0
Morningglory	3	10	10	10	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Nutsedge	0	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rape	7	7	3	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0
Rice	0	2	3	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	3	5	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	5	9	9	3	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Sugar beet	10	10	10	10	9	10	0	0	0	0	0	0	0	0	0	0	0	0
Velvetleaf	5	10	10	10	1	6	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	1	0	4	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	4	9	9	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Wild oat	4	2	4	2	9	3	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B

Rate 100 g/ha	COMPOUND																			
	1	41	42	43	44	45	85	88	89	90	91	92	94	104	110	111	117	130	131	132
POSTEMERGENCE																				
Barley	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	8	2	1	1	1	0	2	1	0	1	2	1	1	2	0	2	0	1	0	0
Bedstraw	4	4	4	2	2	2	2	3	0	3	0	1	2	1	0	3	1	5	2	1
Blackgrass	4	3	1	1	1	1	1	2	0	3	2	2	2	0	0	2	0	1	0	0
Chickweed	4	3	2	1	1	1	1	1	0	0	0	1	0	0	0	2	0	0	0	0
Cocklebur	1	1	2	2	2	2	2	2	1	2	1	0	1	2	0	3	0	0	1	3
Corn	5	2	1	1	1	1	1	2	1	1	4	1	1	1	0	2	0	0	0	0
Cotton	3	0	0	0	0	0	2	2	2	6	2	2	4	3	2	9	3	3	3	1
Crabgrass	7	3	1	1	1	1	2	1	2	1	4	1	2	2	0	2	0	0	0	0
Downy brome	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Giant foxtail	8	3	1	1	1	0	1	1	1	2	2	2	2	2	0	1	0	0	0	0
Lambsquarter	8	-	2	2	1	1	3	4	2	7	7	4	6	7	2	4	0	-	3	0
Morningglory	6	1	3	2	2	2	2	3	2	4	1	2	2	2	1	2	2	2	2	1
Nutsedge	4	-	0	-	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rape	2	2	2	2	1	1	3	2	1	3	3	2	3	3	0	6	0	0	2	0
Rice	6	0	0	0	0	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0
Sorghum	1	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0
Soybean	3	0	0	1	2	0	4	6	5	8	4	3	5	4	2	3	2	2	3	1
Sugar beet	6	0	0	2	2	1	7	6	2	3	3	3	4	4	3	6	0	0	2	0
Velvetleaf	3	2	6	5	1	0	2	1	1	1	2	2	2	2	1	2	2	1	0	0
Wheat	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Wild buckwheat	2	1	1	0	1	1	2	0	0	2	0	0	0	2	0	1	0	2	3	1
Wild oat	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

TABLE B

Rate 100 g/ha	COMPOUND																			
	1	41	42	43	44	45	85	88	89	90	91	92	94	104	110	111	117	130	131	132
PREEMERGENCE																				
Barley	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnyardgrass	7	6	4	1	3	1	0	0	0	3	0	3	0	0	0	0	0	2	0	0
Bedstraw	9	1	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blackgrass	4	3	1	0	2	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0
Chickweed	7	6	0	3	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Cocklebur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corn	3	4	1	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0
Cotton	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crabgrass	7	9	9	8	9	5	1	2	1	6	1	7	0	0	0	0	1	5	0	0
Downy brome	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Giant foxtail	7	9	8	7	6	5	1	3	1	7	2	4	2	2	0	0	1	5	0	0
Lambsquarter	9	9	8	4	4	0	0	0	2	8	0	7	0	0	0	3	0	-	0	0
Morningglory	-	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	9	0	0
Nutsedge	-	0	0	0	0	-	0	0	0	0	-	0	-	0	-	-	0	0	0	0
Rape	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rice	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soybean	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugar beet	10	6	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	2	0	0
Velvetleaf	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wild buckwheat	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Wild oat	4	4	3	1	1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0

TEST C

The compounds evaluated in this test were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied to the soil surface before plant seedlings emerged (preemergence application), to water that covered the soil surface (flood application), and to plants that were in the one-to-four leaf stage (postemergence application). A sandy loam soil was used for the preemergence and postemergence tests, while a silt loam soil was used in the flood test. Water depth was approximately 2.5 cm for the flood test and was maintained at this level for the duration of the test.

Plant species in the preemergence and postemergence tests consisted of barnyardgrass (*Echinochloa crus-galli*), barley (*Hordeum vulgare*), bedstraw (*Galium aparine*), blackgrass (*Alopecurus myosuroides*), chickweed (*Stellaria media*), cocklebur (*Xanthium strumarium*), corn (*Zea mays*), cotton (*Gossypium hirsutum*), crabgrass (*Digitaria sanguinalis*), downy brome (*Bromus tectorum*), giant foxtail (*Setaria faberii*), johnsongrass (*Sorghum halepense*), lambsquarters (*Chenopodium album*), morningglory (*Ipomoea hederacea*), pigweed (*Amaranthus retroflexus*), rape (*Brassica napus*), ryegrass (*Lolium multiflorum*), soybean (*Glycine max*), speedwell (*Veronica persica*), sugar beet (*Beta vulgaris*), velvetleaf (*Abutilon theophrasti*), wheat (*Triticum aestivum*), wild buckwheat (*Polygonum convolvulus*), and wild oat (*Avena fatua*). All plant species were planted one day before application of the compound for the preemergence portion of this test. Plantings of these species were adjusted to produce plants of appropriate size for the postemergence portion of the test. Plant species in the flood test consisted of rice (*Oryza sativa*), umbrella sedge (*Cyperus difformis*), duck salad (*Heteranthera limosa*), barnyardgrass (*Echinochloa crus-galli*) and late watergrass (*Echinochloa oryzicola*) grown to the 2 leaf stage for testing.

All plant species were grown using normal greenhouse practices. Visual evaluations of injury expressed on treated plants, when compared to untreated controls, were recorded approximately fourteen to twenty one days after application of the test compound. Plant response this ratings, summarized in Table C, were recorded on a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash (-) response means no test result.

TABLE C	COMPOUND			
Rate 1000 g/ha	2	46	47	48
POSTEMERGENCE				
Barley Igri	80	65	60	35
Barnyardgr Flood	95	95	95	90
Barnyardgrass	90	90	90	90
Bedstraw	65	90	90	65
Blackgrass	70	95	65	95
Chickweed	95	90	90	90
Cocklebur	60	90	75	70
Corn	80	85	35	50
Cotton	70	90	90	100
Crabgrass	90	90	85	90
Downy Brome	80	95	20	50
Duck salad	95	100	95	95
Giant foxtail	90	90	90	90
Italn Ryegrass	85	90	80	75
Johnsongrass	80	90	50	70
Lambsquarter	100	100	95	95
Morningglory	95	90	90	90
Rape	100	95	85	100
Redroot Pigweed	90	90	70	90
Rice Japonica	80	95	85	90
Soybean	60	90	90	90
Speedwell	90	100	100	100
Sugar beet	90	95	100	100
Umbrella sedge	90	90	90	90
Velvetleaf	50	90	80	85
Watergrass 2	90	95	80	90
Wheat	70	65	10	35
Wild buckwheat	90	95	25	90
Wild oat	85	90	80	70

TABLE C	COMPOUND			
Rate 1000 g/ha	2	46	47	48
PREEMERGENCE				
Barley Igri	90	95	85	50
Barnyardgrass	95	100	100	100
Bedstraw	100	100	100	95
Blackgrass	95	100	100	100
Chickweed	100	100	95	100
Cocklebur	40	90	35	25
Corn	60	90	70	40
Cotton	75	95	35	90
Crabgrass	100	100	100	95
Downy Brome	100	100	75	50
Giant foxtail	100	100	100	100
Italn Ryegrass	100	100	95	90
Johnsongrass	90	90	90	80
Lambsquarter	100	100	95	100
Morningglory	100	100	100	85
Rape	100	100	100	100
Redroot Pigweed	90	100	80	100
Soybean	75	100	90	70
Speedwell	100	100	100	100
Sugar beet	100	100	100	100
Velvetleaf	100	100	100	100
Wheat	95	95	95	60
Wild buckwheat	100	95	25	100
Wild oat	90	95	90	80

TABLE C POSTEMERGENCE

Rate 500 g/ha	2	6	23	42	46	47	48	52	53	55	58	61	63	68	69	71	73	74	77	112	114	115
									COMPOUND													
Barley Igri	80	90	75	0	65	50	30	90	65	35	40	30	0	40	70	10	85	35	-	10	0	65
Barnyardgr Flood	85	95	90	80	90	85	90	100	95	95	70	85	70	95	100	20	100	95	90	85	90	95
Barnyardgrass	80	95	90	70	90	80	90	95	95	90	90	90	85	95	95	30	95	90	95	85	80	90
Bedstraw	60	95	90	75	90	90	65	90	95	90	90	40	40	90	95	30	90	60	-	60	85	95
Blackgrass	70	100	70	50	95	60	85	95	95	75	70	35	30	75	95	35	95	90	-	60	25	65
Chickweed	85	100	65	60	90	80	85	90	95	95	95	80	50	100	90	60	90	50	-	30	-	90
Cocklebur	50	90	90	35	80	75	70	60	50	75	80	10	100	80	85	50	90	-	80	30	65	40
Corn	60	90	60	30	55	30	50	70	70	35	50	50	10	65	80	25	85	70	70	40	40	20
Cotton	70	90	80	20	90	80	100	90	95	100	90	100	100	100	100	100	100	-	100	95	70	90
Crabgrass	80	95	85	80	90	85	90	95	90	90	90	80	30	80	90	35	95	70	80	25	45	80
Downy Brome	75	90	70	0	80	10	0	45	35	10	10	0	90	40	70	0	60	60	-	0	0	35
Duck salad	90	-	80	30	95	95	95	-	-	-	65	95	65	85	95	0	95	95	95	80	90	90
Giant foxtail	90	95	75	90	90	90	90	90	95	70	90	90	70	75	90	30	100	75	90	50	60	90
Italn Ryegrass	85	95	85	15	90	70	20	95	85	40	70	30	0	60	90	0	95	85	-	30	70	90
Johnsongrass	70	95	90	25	70	40	70	90	90	50	50	30	40	85	85	50	90	80	50	35	30	50
Lambsquarter	100	100	90	35	100	95	95	100	100	100	100	100	90	100	100	80	95	95	-	95	95	95
Morningglory	90	70	80	60	90	90	90	95	95	100	90	50	100	85	80	60	85	50	80	90	80	60
Rape	90	90	80	60	95	85	95	100	90	100	100	95	95	100	100	-	100	100	-	70	90	95
Redroot Pigweed	70	90	90	50	90	70	90	90	90	95	90	90	90	90	90	90	90	80	85	90	100	100
Rice Japonica	70	95	70	35	90	80	80	85	90	80	60	70	60	90	90	20	95	75	85	70	80	95
Soybean	50	70	85	20	90	90	90	65	80	65	90	70	95	95	95	60	100	90	90	80	75	80
Speedwell	90	100	95	25	100	100	100	100	70	100	100	100	60	-	-	-	100	100	-	95	80	65
Sugar beet	90	100	95	45	95	100	95	100	100	100	100	100	100	100	95	40	100	90	-	70	95	90
Umbrella sedge	90	100	80	85	90	90	90	100	90	90	70	65	60	100	100	10	95	100	90	95	95	95
Velvetleaf	40	40	60	70	90	80	80	85	80	90	65	55	100	90	85	40	90	80	90	95	50	60
Watergrass 2	80	95	90	70	90	70	90	95	95	80	75	80	60	100	100	10	100	95	90	75	95	95
Wheat	65	90	80	10	65	0	10	75	60	10	10	10	0	50	70	-	95	35	-	15	0	30
Wild buckwheat	80	95	85	15	95	0	90	95	75	100	90	90	100	100	30	30	95	0	-	25	100	0
Wild oat	85	95	65	25	80	65	40	95	95	50	80	30	0	90	90	25	100	75	-	15	65	90

TABLE C	COMPOUND
Rate 500 g/ha	133
POSTEMERGENCE	
Barley Igri	35
Barnyardgr Flood	25
Barnyardgrass	45
Bedstraw	40
Blackgrass	65
Chickweed	70
Cocklebur	80
Corn	20
Cotton	100
Crabgrass	30
Downy Brome	10
Duck salad	35
Giant foxtail	55
Italn Ryegrass	40
Johnsongrass	10
Lambsquarter	95
Morningglory	60
Rape	90
Redroot Pigweed	80
Rice Japonica	40
Soybean	90
Speedwell	95
Sugar beet	95
Umbrella sedge	50
Velvetleaf	60
Watergrass 2	25
Wheat	10
Wild buckwheat	85
Wild oat	50

TABLE C

Rate 500 g/ha	COMPOUND																					
	2	6	23	42	46	47	48	52	53	55	58	61	63	68	69	71	73	74	77	112	114	115
PREEMERGENCE																						
Barley Igri	75	95	35	40	90	70	35	65	65	30	70	10	0	-	-	-	-	-	60	10	35	80
Barnyardgrass	90	100	95	100	100	95	100	100	100	100	100	100	80	100	100	20	100	90	100	95	100	100
Bedstraw	100	100	80	90	100	100	95	100	100	100	100	95	0	-	-	-	-	-	95	100	95	100
Blackgrass	90	100	80	100	95	65	90	100	95	100	40	30	10	-	-	-	-	-	100	95	100	100
Chickweed	100	100	95	75	100	95	95	100	100	100	100	95	0	-	-	-	-	-	95	100	55	95
Cocklebur	20	90	30	20	80	25	10	35	20	0	75	0	100	30	50	20	90	35	0	0	0	20
Corn	60	95	60	70	85	65	35	90	85	40	70	35	0	60	80	20	85	65	75	35	65	0
Cotton	40	60	40	20	90	10	70	30	20	40	35	20	70	100	100	0	100	40	30	20	20	100
Crabgrass	95	100	100	100	100	90	90	100	100	100	100	100	65	100	100	25	100	100	100	65	70	100
Downy Brome	85	90	45	35	90	50	35	65	65	45	40	0	0	-	-	-	-	-	50	0	30	80
Giant foxtail	100	100	100	100	100	95	100	100	95	85	100	100	75	100	100	25	100	100	100	100	100	100
Italn Ryegrass	95	95	95	100	100	85	75	95	95	55	95	45	0	-	-	-	-	-	90	40	85	95
Johnsongrass	80	100	85	75	90	70	60	95	90	80	90	70	70	70	80	20	95	80	80	40	70	70
Lambsquarter	100	100	100	100	100	95	100	100	100	100	100	100	65	-	-	-	-	-	100	100	95	95
Morningglory	75	100	100	80	100	100	70	100	100	95	100	70	100	85	100	25	100	70	85	75	100	100
Rape	95	50	100	85	100	90	95	100	100	100	100	90	100	-	-	-	-	-	90	100	45	100
Redroot Pigweed	90	100	100	80	100	80	100	95	90	100	100	100	80	100	100	80	100	100	95	100	100	100
Soybean	55	90	80	10	95	80	45	60	80	45	100	40	75	40	100	20	100	85	90	0	75	65
Speedwell	100	100	100	100	100	100	100	100	80	100	100	100	100	-	-	-	-	-	90	100	95	85
Sugar beet	100	100	100	70	100	100	100	100	100	100	100	100	100	-	-	-	-	-	100	100	100	100
Velvetleaf	100	100	100	100	100	100	90	100	100	100	100	85	90	100	100	60	100	100	100	90	100	100
Wheat	85	95	65	65	95	90	45	75	65	20	35	20	0	-	-	-	-	-	35	0	25	65
Wild buckwheat	90	100	75	20	85	0	95	100	65	100	90	100	10	-	-	-	-	-	20	100	35	0
Wild oat	90	100	65	60	90	70	65	95	95	65	90	20	0	-	-	-	-	-	95	25	65	95

TABLE C.	COMPOUND
Rate 500 g/ha	133
PREEMERGENCE	
Barley Igri	35
Barnyardgrass	95
Bedstraw	25
Blackgrass	55
Chickweed	90
Cocklebur	65
Corn	65
Cotton	30
Crabgrass	100
Downy Brome	40
Giant foxtail	90
Italn Ryegrass	90
Johnsongrass	60
Lambsquarter	100
Morningglory	100
Rape	95
Redroot Pigweed	60
Soybean	90
Speedwell	95
Sugar beet	95
Velvetleaf	40
Wheat	15
Wild buckwheat	100
Wild oat	85

TABLE C POSTEMERGENCE	COMPOUND																				
Rate 250 g/ha	1	2	3	4	6	7	8	9	10	14	18	22	23	24	25	26	29	30	31	32	34	35
Barley Igri	65	65	95	25	90	65	50	65	70	60	35	-	45	20	-	45	20	50	-	0	65	70
Barnyardgr Flood	90	85	95	95	90	95	90	90	90	90	90	85	85	95	85	85	90	90	70	85	95	95
Barnyardgrass	90	80	90	90	95	80	80	90	90	90	85	-	90	90	-	100	65	90	-	50	90	90
Bedstraw	55	60	55	95	85	40	65	90	85	90	95	-	90	85	-	80	40	45	-	65	80	80
Blackgrass	85	65	90	95	95	95	40	60	70	70	50	-	70	70	-	75	45	65	-	40	60	70
Chickweed	80	80	65	70	95	60	25	80	60	85	80	-	55	85	-	100	40	65	-	0	50	75
Cocklebur	35	40	0	40	90	35	0	75	70	60	0	-	80	95	-	95	10	60	-	20	20	10
Corn	75	40	70	70	90	75	60	50	45	70	45	-	45	65	-	50	35	35	-	10	75	80
Cotton	50	50	45	55	90	20	50	70	80	80	70	-	80	100	-	70	85	90	-	30	70	50
Crabgrass	80	50	90	90	90	65	70	85	85	85	80	-	60	85	-	75	75	60	-	30	90	90
Downy Brome	45	70	70	35	70	50	0	40	30	40	10	-	40	0	-	30	0	0	-	40	75	60
Duck salad	50	75	100	95	-	90	55	90	85	80	60	95	80	90	60	40	90	95	55	90	60	95
Giant foxtail	90	80	90	90	90	80	85	90	90	90	90	-	70	70	-	85	60	80	-	50	90	90
Italn Ryegrass	80	65	95	65	95	75	70	90	90	80	80	-	85	85	-	65	45	90	-	20	90	90
Johnsongrass	70	60	90	90	95	90	75	90	80	85	90	-	75	40	-	90	70	90	-	60	80	90
Lambsquarter	75	95	95	95	100	0	65	75	80	80	35	-	90	95	-	100	60	95	-	0	95	80
Morningglory	70	90	70	80	40	50	35	80	80	85	70	-	70	90	-	100	70	85	-	70	80	90
Rape	45	80	35	30	70	20	10	90	40	40	30	-	80	80	-	100	0	95	-	80	55	90
Redroot Pigweed	60	70	90	80	90	70	85	80	80	90	100	-	90	80	-	100	90	90	-	-	70	80
Rice Japonica	85	65	90	95	95	90	75	80	80	80	80	85	70	75	35	65	70	65	55	55	95	95
Soybean	60	40	70	50	50	55	65	90	90	75	90	-	75	80	-	90	90	85	-	70	85	90
Speedwell	75	85	100	90	100	65	40	100	100	100	100	-	95	100	-	-	65	100	-	0	100	100
Sugar beet	85	90	95	100	95	80	95	90	90	95	100	-	90	95	-	100	75	90	-	80	90	90
Umbrella sedge	95	90	95	95	95	85	80	85	90	85	80	95	80	95	95	95	95	95	50	95	40	95
Velvetleaf	30	40	35	60	-	65	50	80	70	55	40	-	40	80	-	80	30	35	-	50	50	50
Watergrass 2	90	75	95	95	90	95	95	90	90	90	90	90	90	95	70	90	90	95	65	85	95	95
Wheat	65	60	90	25	90	60	35	40	60	40	35	-	80	10	-	10	10	0	-	0	50	70
Wild buckwheat	80	80	95	95	90	30	35	100	90	90	70	-	70	35	-	95	30	80	-	80	70	90
Wild oat	80	70	85	70	95	90	70	70	70	70	70	-	65	45	-	85	40	85	-	85	80	90

TABLE C POSTEMERGENCE

Rate 250 g/ha	COMPOUND 36	39	40	41	42	46	47	48	49	50	51	52	53	55	58	61	63	68	69	71	73	74
Barley Igri	60	45	50	0	0	60	20	10	30	45	45	80	40	25	35	30	0	25	70	10	75	35
Barnyardgr Flood	95	90	85	90	60	85	70	90	60	95	70	95	90	95	65	80	65	95	95	0	100	85
Barnyardgrass	80	90	90	50	35	90	70	90	60	95	70	90	65	40	90	80	70	90	90	20	95	90
Bedstraw	60	85	20	15	25	85	90	65	35	85	65	90	90	90	90	40	0	90	75	30	90	30
Blackgrass	55	60	70	35	15	95	50	75	35	95	65	90	90	70	60	30	30	75	95	10	95	70
Chickweed	40	65	100	65	55	90	65	85	65	95	65	85	85	95	-	70	-	100	90	40	90	50
Cocklebur	30	85	20	55	25	80	60	50	50	90	60	50	40	50	70	0	100	70	70	50	90	50
Corn	60	50	40	35	15	50	20	35	30	70	35	35	35	-	40	40	0	45	70	20	80	60
Cotton	50	100	35	20	10	80	80	95	95	100	90	90	95	95	90	100	95	100	100	90	100	90
Crabgrass	80	80	90	50	50	90	55	80	40	95	40	75	50	50	80	70	20	60	70	30	85	50
Downy Brome	60	50	20	0	0	30	0	0	0	0	10	25	10	10	0	0	0	40	45	0	50	20
Duck salad	85	80	65	10	25	90	85	75	90	100	90	-	-	-	40	90	60	65	95	0	95	85
Giant foxtail	70	90	90	35	40	90	90	60	35	95	35	80	90	40	90	90	50	70	80	20	90	45
Italn Ryegrass	85	90	95	10	10	80	45	0	35	90	65	85	80	25	50	20	0	60	80	0	95	80
Johnsongrass	80	70	30	45	10	70	30	30	30	60	45	65	40	50	40	20	20	50	70	40	90	40
Lambsquarter	70	95	95	20	30	100	90	95	95	100	95	95	100	100	100	95	80	95	100	0	95	95
Morningglory	70	90	80	35	40	90	90	45	90	100	60	80	-	90	90	40	100	80	75	40	85	50
Rape	60	85	90	20	25	95	80	90	80	95	65	90	90	95	90	90	95	100	100	40	100	70
Redroot Pigweed	90	90	80	70	35	90	50	90	60	90	90	90	80	90	90	90	80	90	80	55	80	80
Rice Japonica	95	85	35	35	20	80	70	70	35	80	30	80	85	70	50	65	40	70	80	10	90	65
Soybean	80	80	10	30	15	90	80	70	80	90	90	60	-	65	90	70	90	90	95	50	90	90
Speedwell	95	100	100	35	25	95	100	95	100	100	100	100	45	100	100	100	-	100	100	90	100	100
Sugar beet	80	100	95	75	10	95	95	95	100	100	95	100	100	100	90	100	95	100	80	30	90	90
Umbrella sedge	85	80	90	65	70	80	90	80	-	100	100	95	90	85	60	60	60	95	95	0	95	95
Velvetleaf	40	50	70	40	20	90	75	60	50	90	80	65	60	80	55	50	90	90	80	30	80	35
Watergrass 2	95	85	90	90	40	85	55	80	35	95	70	85	85	75	60	65	40	95	95	0	100	90
Wheat	50	60	40	10	10	45	0	0	15	15	25	35	35	0	0	0	0	40	40	30	75	35
Wild buckwheat	40	100	40	20	0	95	0	85	40	90	25	95	30	85	80	90	90	70	20	0	90	0
Wild oat	80	70	80	15	20	70	10	0	25	70	75	90	80	40	40	20	0	75	85	25	95	60

TABLE C	COMPOUND				
Rate 250 g/ha	77	112	114	115	133
POSTEMERGENCE					
Barley Igri	-	0	0	60	0
Barnyardgr Flood	90	80	80	95	20
Barnyardgrass	75	70	80	80	25
Bedstraw	-	50	65	90	10
Blackgrass	-	60	10	50	30
Chickweed	-	30	40	90	70
Cocklebur	80	25	55	40	50
Corn	30	30	30	10	10
Cotton	90	95	60	90	70
Crabgrass	70	20	40	70	20
Downy Brome	-	0	0	25	10
Duck salad	95	65	65	90	30
Giant foxtail	90	40	40	90	30
Italn Ryegrass	-	25	50	80	0
Johnsongrass	30	30	30	40	10
Lambsquarter	-	95	95	95	90
Morningglory	80	90	70	60	60
Rape	-	70	90	90	90
Redroot Pigweed	80	90	100	90	80
Rice Japonica	80	50	70	90	40
Soybean	80	70	75	80	90
Speedwell	-	95	-	65	90
Sugar beet	-	70	95	90	65
Umbrella sedge	85	90	95	95	20
Velvetleaf	80	95	35	40	60
Watergrass 2	90	65	85	85	20
Wheat	-	15	0	0	0
Wild buckwheat	-	10	70	0	30
Wild oat	-	15	20	75	10

TABLE C PREEMERGENCE

Rate 250 g/ha	COMPOUND 1	2	3	4	6	7	8	9	10	14	18	23	24	26	29	30	32	34	35	36	39	40
Barley Igri	90	70	100	70	90	90	70	70	80	70	75	35	0	30	0	10	0	70	65	50	0	90
Barnyardgrass	90	90	90	100	95	95	90	95	95	95	90	90	90	65	95	90	0	95	90	90	95	90
Bedstraw	100	95	100	100	95	100	50	90	100	85	90	80	100	100	85	95	0	100	100	95	100	25
Blackgrass	70	75	100	100	100	95	70	70	90	85	95	70	95	95	35	70	65	95	80	80	90	95
Chickweed	75	95	100	100	-	95	85	95	95	100	100	95	95	95	70	70	10	100	100	100	95	100
Cocklebur	30	10	50	80	85	0	30	45	70	40	30	30	0	0	20	60	0	0	20	30	40	20
Corn	80	30	70	90	90	90	70	75	80	75	65	50	50	40	35	50	0	75	75	70	55	60
Cotton	20	10	60	35	30	0	30	0	20	20	20	-	0	20	30	55	10	30	80	50	50	0
Crabgrass	100	60	100	100	100	100	95	100	100	100	100	100	100	100	100	100	30	100	100	100	100	100
Downy Brome	60	85	100	100	90	50	65	90	70	50	45	30	30	10	0	10	0	95	85	70	70	85
Giant foxtail	100	95	100	100	100	95	95	100	100	100	100	90	85	100	95	100	20	100	100	100	100	100
Italn Ryegrass	100	90	100	100	95	95	95	95	90	95	85	85	95	85	35	65	0	95	100	90	90	95
Johnsongrass	95	80	100	100	100	95	80	95	100	90	90	85	70	80	95	90	10	95	90	90	90	80
Lambsquarter	95	100	100	100	100	50	70	95	100	95	100	100	100	100	95	100	90	100	100	100	95	100
Morningglory	100	35	100	100	85	75	50	100	100	90	100	100	50	70	100	100	0	100	100	100	100	60
Rape	60	50	45	95	50	0	0	65	95	10	25	100	0	100	15	30	20	0	100	85	10	90
Redroot Pigweed	75	90	90	90	90	70	90	100	100	100	100	100	90	100	100	100	0	100	100	100	100	90
Soybean	80	35	90	90	90	85	50	75	70	60	35	60	10	15	40	45	30	70	90	85	40	10
Speedwell	75	100	100	100	100	80	100	95	100	100	100	100	100	100	80	100	60	100	100	100	100	100
Sugar beet	100	95	100	100	100	100	85	100	100	95	100	100	100	100	100	100	50	100	100	100	100	100
Velvetleaf	100	75	100	100	100	95	90	100	100	90	100	100	100	100	100	100	40	100	100	100	100	60
Wheat	90	70	100	100	95	95	85	80	90	65	65	35	0	0	0	35	0	85	90	60	20	95
Wild buckwheat	90	90	100	100	100	20	20	100	80	40	40	70	90	95	25	90	65	30	100	100	100	40
Wild oat	100	80	100	95	95	95	90	85	80	85	70	60	40	75	45	70	45	95	90	85	75	90

TABLE C PREEMERGENCE

	COMPOUND																					
Rate 250 g/ha	41	42	46	47	48	49	50	51	52	53	55	58	61	63	68	69	71	73	74	77	112	114
Barley Igri	55	10	90	55	0	30	95	70	50	60	30	40	0	0	-	-	-	-	-	50	10	20
Barnyardgrass	95	100	100	90	90	65	100	90	100	95	95	100	90	45	95	100	10	100	90	95	90	95
Bedstraw	10	60	100	100	95	0	100	20	90	50	95	100	80	0	-	-	-	-	-	90	80	0
Blackgrass	95	90	95	60	85	50	100	65	100	95	95	25	20	10	-	-	-	-	-	95	95	80
Chickweed	45	65	100	95	90	30	100	35	60	85	100	100	95	-	-	-	-	-	-	40	95	30
Cocklebur	100	10	50	10	0	10	90	20	20	20	0	65	0	80	10	40	0	90	20	0	0	0
Corn	75	55	80	50	20	50	80	65	80	70	30	60	35	0	40	80	0	85	55	55	35	45
Cotton	0	0	50	0	60	0	100	0	20	10	40	30	10	70	85	95	0	100	20	20	20	10
Crabgrass	100	100	100	80	90	60	100	80	100	100	100	100	90	30	100	100	0	100	90	100	35	40
Downy Brome	70	10	70	0	35	10	70	20	50	60	10	30	0	0	-	-	-	-	-	45	0	30
Giant foxtail	100	100	100	95	100	100	100	100	85	90	85	100	100	65	100	100	10	100	85	100	100	100
Italn Ryegrass	60	50	80	50	60	30	95	80	90	85	50	75	30	0	-	-	-	-	-	85	40	80
Johnsongrass	90	40	80	55	35	20	90	65	90	90	60	65	30	50	40	70	10	90	50	50	30	30
Lambsquarter	100	95	100	95	100	100	100	90	100	100	100	100	100	65	-	-	-	-	-	100	100	95
Morningglory	85	40	100	95	30	20	100	20	100	100	80	100	50	70	70	100	0	100	50	80	60	70
Rape	60	35	100	65	90	0	100	70	90	20	0	100	90	95	-	-	-	-	-	90	45	10
Redroot Pigweed	100	70	95	40	95	75	100	80	90	90	100	100	100	80	100	100	0	100	40	90	100	95
Soybean	20	0	95	40	40	10	100	40	40	70	20	90	30	60	20	95	0	95	50	65	0	40
Speedwell	100	60	100	100	100	100	100	95	100	80	100	100	100	10	-	-	-	-	-	90	100	95
Sugar beet	100	60	100	100	100	90	100	100	100	100	100	100	100	40	-	-	-	-	-	100	100	100
Velvetleaf	80	35	100	90	90	0	100	50	100	100	100	95	60	75	100	100	0	100	80	100	90	90
Wheat	75	0	80	80	30	0	90	40	35	60	20	30	10	0	-	-	-	-	-	20	0	25
Wild buckwheat	25	10	70	0	95	60	100	40	85	55	95	35	95	10	-	-	-	-	-	20	75	30
Wild oat	75	30	90	50	20	20	95	65	80	90	35	60	20	0	-	-	-	-	-	90	10	30

TABLE C	COMPOUND	
Rate 250 g/ha	115	133
PREEMERGENCE		
Barley Igri	60	0
Barnyardgrass	95	90
Bedstraw	95	10
Blackgrass	95	10
Chickweed	80	25
Cocklebur	0	35
Corn	0	10
Cotton	40	20
Crabgrass	100	90
Downy Brome	80	0
Giant foxtail	100	30
Italn Ryegrass	90	40
Johnsongrass	50	30
Lambsquarter	95	100
Morningglory	75	50
Rape	90	70
Redroot Pigweed	100	30
Soybean	50	65
Speedwell	40	65
Sugar beet	100	95
Velvetleaf	90	30
Wheat	40	10
Wild buckwheat	0	35
Wild oat	70	10

TABLE C POSTEMERGENCE

Rate 125 g/ha	COMPOUND 1	2	3	4	6	7	8	9	10	14	18	22	23	24	25	26	28	29	30	31	32	34
Barley Igri	55	55	70	20	80	30	35	45	50	40	30	-	40	0	-	45	-	0	20	-	0	50
Barnyardgr Flood	80	75	85	90	75	90	85	85	90	85	90	80	75	90	80	80	85	85	80	65	70	90
Barnyardgrass	70	70	90	90	85	80	70	80	80	80	70	-	80	80	-	90	-	55	80	-	10	80
Bedstraw	45	50	50	85	60	30	50	80	60	80	90	-	85	65	-	70	-	40	45	-	60	80
Blackgrass	75	50	90	95	65	45	40	50	60	60	40	-	70	60	-	50	-	35	65	-	40	40
Chickweed	55	80	65	70	80	45	25	70	60	80	80	-	50	85	-	95	-	40	65	-	0	40
Cocklebur	25	-	0	35	50	-	0	50	40	35	0	-	60	70	-	90	-	10	60	-	0	0
Corn	60	40	60	70	50	60	50	40	40	60	40	-	40	70	-	40	-	25	25	-	10	70
Cotton	40	-	35	35	90	20	50	70	80	70	70	-	70	100	-	60	-	80	90	-	10	70
Crabgrass	70	40	90	80	85	50	70	70	60	65	70	-	30	50	-	70	-	55	50	-	0	80
Downy Brome	35	45	20	25	10	20	0	20	30	30	0	-	30	0	-	0	-	0	0	-	0	55
Duck salad	50	70	95	90	-	35	50	70	60	70	60	75	80	90	50	30	60	75	80	50	85	45
Giant foxtail	90	70	90	90	90	40	80	75	80	80	80	-	60	60	-	70	-	50	60	-	30	50
Italn Ryegrass	50	65	80	40	90	50	60	45	60	60	60	-	70	75	-	60	-	40	60	-	20	80
Johnsongrass	50	60	80	90	70	80	60	80	60	60	70	-	60	40	-	80	-	60	60	-	50	80
Lambsquarter	75	95	90	95	100	0	65	50	80	80	30	-	90	95	-	100	-	60	95	-	0	40
Morningglory	60	85	60	80	40	40	30	80	70	-	70	-	70	90	-	95	-	70	70	-	50	70
Rape	40	80	10	30	65	0	10	70	30	20	20	-	70	80	-	100	-	0	70	-	80	35
Redroot Pigweed	60	70	80	80	90	60	80	80	70	80	90	-	90	-	-	90	-	90	90	-	-	70
Rice Japonica	70	60	85	90	80	80	75	70	70	80	70	70	70	65	25	60	70	60	45	50	40	90
Soybean	40	-	70	40	-	45	60	90	90	75	80	-	60	80	-	90	-	85	85	-	60	85
Speedwell	50	85	90	90	100	65	25	100	100	100	100	-	95	95	-	100	-	65	100	-	0	60
Sugar beet	80	90	95	90	95	80	95	80	90	80	100	-	90	95	-	95	-	70	90	-	80	70
Umbrella sedge	90	90	80	85	95	70	60	75	80	75	70	95	80	95	90	90	90	90	85	50	95	35
Velvetleaf	25	25	30	40	40	30	40	60	50	-	40	-	25	50	-	60	-	30	25	-	35	40
Watergrass 2	90	70	95	90	75	85	85	85	80	80	85	85	90	90	65	85	90	90	80	65	70	95
Wheat	50	35	35	25	40	40	10	20	40	20	25	-	60	0	-	0	-	10	0	-	0	30
Wild buckwheat	60	80	90	90	65	20	35	85	90	70	70	-	65	35	-	95	-	30	80	-	80	40
Wild oat	70	60	80	60	85	80	65	60	60	60	55	-	50	45	-	80	-	40	75	-	80	70

TABLE C POSTEMERGENCE

Rate 125 g/ha	COMPOUND 35	36	37	38	39	40	41	42	46	47	48	49	50	51	52	53	55	58	61	63	68	69
Barley Igri	70	40	45	55	40	35	0	0	60	10	0	30	45	45	35	20	10	20	20	0	10	50
Barnyardgr Flood	95	85	85	80	80	85	80	35	70	60	90	45	95	60	80	75	65	45	75	40	75	85
Barnyardgrass	90	70	90	90	75	80	40	20	80	45	60	20	95	40	50	60	30	40	30	30	70	90
Bedstraw	80	45	65	50	85	20	10	20	85	80	65	35	80	50	90	80	90	70	40	0	90	60
Blackgrass	60	45	75	65	50	70	20	10	80	35	30	30	85	40	80	85	50	45	25	20	65	85
Chickweed	55	40	65	65	40	90	45	55	90	40	80	50	90	40	80	65	80	90	70	50	95	90
Cocklebur	0	20	35	0	80	10	45	10	55	60	50	40	80	60	50	25	50	70	0	100	70	70
Corn	70	50	70	50	40	25	20	10	35	-	35	20	55	25	20	20	30	0	20	0	35	50
Cotton	40	50	90	85	90	35	10	0	60	55	95	90	95	90	90	90	95	85	90	90	100	95
Crabgrass	-	50	90	90	50	90	40	40	80	35	50	30	90	30	75	40	35	60	40	10	40	55
Downy Brome	40	30	35	30	20	15	0	0	30	0	0	0	0	10	0	0	0	0	0	0	35	35
Duck salad	90	75	70	50	70	35	0	0	90	75	75	-	-	70	-	-	-	25	30	40	35	95
Giant foxtail	70	50	90	90	70	80	25	30	90	55	40	25	90	-	65	30	30	90	40	40	40	50
Italn Ryegrass	80	75	90	95	90	80	10	0	70	25	0	0	90	50	65	0	0	10	20	0	35	80
Johnsongrass	80	70	85	90	40	20	35	10	35	25	-	20	50	40	30	30	35	20	10	10	35	40
Lambsquarter	70	60	85	65	95	0	10	25	100	90	95	90	95	75	95	100	95	90	90	70	95	90
Morningglory	80	70	80	80	80	60	30	25	85	75	35	80	95	50	80	80	80	80	40	100	70	70
Rape	80	50	95	30	80	60	10	25	95	75	90	60	95	40	90	80	80	70	90	80	100	95
Redroot Pigweed	-	90	80	90	90	50	50	25	90	45	90	50	80	80	80	80	90	80	90	70	90	60
Rice Japonica	90	85	75	70	75	25	25	10	75	45	65	30	75	25	70	55	50	30	25	20	65	70
Soybean	90	80	90	80	70	10	10	10	85	80	60	50	90	85	60	70	55	80	40	40	75	90
Speedwell	70	50	100	100	100	100	30	25	95	100	95	100	100	100	100	40	100	100	100	60	100	100
Sugar beet	90	80	60	90	100	90	35	10	-	90	95	95	100	90	100	90	100	80	95	95	100	80
Umbrella sedge	90	75	75	50	80	85	65	35	80	90	80	-	100	100	85	90	75	55	45	45	90	90
Velvetleaf	-	30	55	45	50	50	30	10	90	60	40	40	90	65	50	40	60	50	35	90	90	70
Watergrass 2	95	85	70	90	70	85	80	20	70	35	75	20	95	40	70	75	65	25	45	20	75	85
Wheat	60	0	20	65	25	25	0	10	10	0	0	10	15	20	10	0	0	0	0	0	30	30
Wild buckwheat	70	40	80	95	40	30	20	0	95	0	75	40	80	25	80	30	70	70	90	90	70	20
Wild oat	80	70	85	95	65	60	15	20	65	0	0	15	70	40	80	70	30	20	20	0	75	80

TABLE C	COMPOUND							
Rate 125 g/ha	71	73	74	77	112	114	115	133
POSTEMERGENCE								
Barley Igri	0	70	0	-	0	0	40	0
Barnyardgr Flood	0	95	75	85	75	80	80	20
Barnyardgrass	10	95	80	40	60	40	70	10
Bedstraw	30	85	20	-	50	60	90	10
Blackgrass	10	95	70	-	50	10	50	20
Chickweed	40	90	50	-	25	40	80	50
Cocklebur	40	80	50	70	20	55	30	50
Corn	0	70	40	20	20	20	0	0
Cotton	80	95	90	90	95	60	70	50
Crabgrass	20	70	40	50	15	40	50	10
Downy Brome	0	40	0	-	0	0	10	10
Duck salad	0	90	70	95	35	45	90	20
Giant foxtail	10	80	20	75	35	35	75	10
Italn Ryegrass	0	95	30	-	25	10	65	0
Johnsongrass	35	50	20	20	25	20	30	0
Lambsquarter	0	95	90	-	95	95	90	90
Morningglory	20	70	45	80	85	40	40	50
Rape	40	95	70	-	70	75	90	80
Redroot Pigweed	45	70	60	75	90	100	80	60
Rice Japonica	0	85	30	70	40	60	85	40
Soybean	35	90	80	80	70	65	60	80
Speedwell	40	100	60	-	95	70	60	-
Sugar beet	10	70	90	-	70	90	85	65
Umbrella sedge	0	85	85	80	85	95	95	0
Velvetleaf	20	75	25	80	90	35	35	35
Watergrass 2	0	95	65	75	50	75	70	10
Wheat	20	70	30	-	10	0	0	0
Wild buckwheat	0	80	0	-	0	40	0	30
Wild oat	10	95	30	-	15	10	65	0

TABLE C

Rate 125 g/ha	COMPOUND																					
	1	2	3	4	6	7	8	9	10	14	18	23	24	26	29	30	32	34	35	36	37	38
PREEMERGENCE																						
Barley Igri	90	70	100	70	80	85	70	40	70	50	65	35	0	0	0	0	0	60	65	40	70	90
Barnyardgrass	90	80	90	100	95	85	90	90	90	90	90	75	70	50	90	80	0	95	90	90	90	100
Bedstraw	90	90	100	100	35	90	50	0	0	70	35	20	95	100	60	85	0	85	100	90	100	100
Blackgrass	70	65	100	100	90	95	70	60	80	65	85	55	60	85	35	45	60	80	80	65	65	100
Chickweed	75	95	95	100	100	70	75	95	95	10	95	90	85	90	20	60	0	95	100	95	95	95
Cocklebur	20	10	30	65	70	0	20	35	40	30	20	20	0	0	10	30	0	0	20	20	50	20
Corn	75	30	70	90	80	80	70	70	70	65	55	40	40	20	25	40	0	70	65	60	75	75
Cotton	20	0	50	20	20	0	30	0	20	10	20	20	0	0	10	0	0	-	35	30	20	70
Crabgrass	90	50	100	100	95	100	90	100	100	100	100	100	70	90	95	95	20	100	100	100	100	100
Downy Brome	50	85	80	100	70	50	40	65	40	50	10	0	0	10	0	10	0	90	80	40	85	95
Giant foxtail	100	80	100	100	100	80	90	95	75	90	100	90	65	90	75	95	10	90	100	100	100	100
Italn Ryegrass	90	75	100	95	95	95	90	90	90	90	80	85	95	60	35	30	0	90	100	85	95	95
Johnsongrass	90	60	100	100	95	95	70	90	90	90	80	70	50	60	90	80	0	70	90	80	100	100
Lambsquarter	95	100	100	100	100	30	60	95	100	95	95	100	95	100	90	95	85	100	100	100	95	100
Morningglory	100	20	100	100	70	30	40	50	80	70	85	65	50	70	65	90	0	90	100	90	100	100
Rape	30	50	45	95	30	0	0	65	35	0	0	95	0	80	0	-	-	0	95	65	100	40
Redroot Pigweed	70	90	90	80	90	45	50	90	80	50	95	75	-	100	100	100	-	100	100	100	100	100
Soybean	80	10	90	90	75	40	40	50	40	40	30	40	0	10	20	10	0	40	90	70	90	90
Speedwell	75	95	100	100	95	70	65	90	95	100	100	95	100	100	30	100	60	100	100	100	100	100
Sugar beet	95	-	100	100	100	30	70	100	65	85	85	100	100	100	20	100	50	100	100	100	100	100
Velvetleaf	80	60	100	100	100	95	80	100	80	80	100	50	90	50	80	70	35	100	100	85	100	100
Wheat	90	60	100	100	90	90	75	50	90	50	55	0	0	0	0	35	0	70	80	40	90	95
Wild buckwheat	80	80	100	100	95	10	20	0	60	20	10	50	90	90	15	60	65	30	100	30	100	100
Wild oat	90	65	100	95	80	90	90	80	80	85	65	50	35	10	25	0	45	90	85	75	85	85

TABLE C

Rate 125 g/ha	COMPOUND																					
	39	40	41	42	46	47	48	49	50	51	52	53	55	58	61	63	68	69	71	73	74	77
PREEMERGENCE																						
Barley Igri	0	80	10	10	65	35	0	10	90	35	30	60	30	10	0	0	-	-	-	-	-	45
Barnyardgrass	85	90	90	90	95	80	70	30	100	90	95	90	70	90	50	45	75	95	0	100	85	90
Bedstraw	90	20	10	0	95	0	75	0	100	0	70	10	-	50	10	0	-	-	-	-	-	10
Blackgrass	55	95	80	70	70	50	70	25	100	60	90	85	70	25	10	0	-	-	-	-	-	85
Chickweed	-	100	10	65	95	35	80	0	95	35	50	10	90	95	85	0	-	-	-	-	-	40
Cocklebur	30	10	10	0	35	0	0	0	80	20	0	10	0	20	0	70	0	35	0	80	0	0
Corn	40	40	50	50	70	35	10	10	80	45	70	50	30	45	0	0	25	70	0	80	40	40
Cotton	50	0	0	0	25	0	30	0	90	0	0	0	20	0	-	10	40	40	0	95	20	0
Crabgrass	100	100	100	100	100	65	50	30	100	60	100	100	90	100	75	20	30	85	0	100	30	95
Downy Brome	60	85	40	10	60	0	30	10	60	20	30	35	10	10	0	0	-	-	-	-	-	40
Giant foxtail	95	90	100	100	100	95	95	60	100	90	55	75	60	100	90	55	85	80	0	100	20	90
Italn Ryegrass	90	95	50	20	80	40	60	30	80	75	85	80	30	70	10	0	-	-	-	-	-	65
Johnsongrass	70	50	40	10	70	20	30	10	80	20	70	75	40	20	10	50	20	60	0	80	35	50
Lambsquarter	-	100	80	95	100	95	100	40	100	30	95	95	100	100	100	40	-	-	-	-	-	95
Morningglory	80	40	35	20	100	90	15	0	100	20	95	100	80	75	40	-	50	75	0	100	20	70
Rape	0	60	40	10	100	40	35	0	100	35	30	20	0	70	60	90	-	-	-	-	-	20
Redroot Pigweed	100	90	90	40	90	20	95	60	100	80	85	75	100	90	90	70	100	95	0	100	30	30
Soybean	30	10	10	0	90	10	20	0	95	30	20	45	10	90	20	30	10	95	0	95	35	45
Speedwell	100	100	80	50	90	100	100	0	100	30	100	80	100	100	95	0	-	-	-	-	-	20
Sugar beet	100	80	100	0	100	95	100	80	100	65	100	100	100	-	100	-	-	-	-	-	-	100
Velvetleaf	100	30	50	0	100	90	80	0	100	30	85	85	70	65	30	55	50	75	0	100	50	85
Wheat	0	90	45	0	70	25	0	0	80	10	30	35	20	20	0	0	-	-	-	-	-	10
Wild buckwheat	90	40	20	0	65	0	90	0	100	25	35	50	70	25	65	10	-	-	-	-	-	15
Wild oat	60	80	35	10	65	35	10	0	95	10	70	70	20	15	0	0	-	-	-	-	-	70

TABLE C	COMPOUND			
Rate 125 g/ha	112	114	115	133
PREEMERGENCE				
Barley Igri	10	15	40	0
Barnyardgrass	90	80	90	40
Bedstraw	35	0	90	10
Blackgrass	85	35	75	0
Chickweed	95	30	70	0
Cocklebur	0	0	0	20
Corn	20	20	0	0
Cotton	0	0	30	10
Crabgrass	25	30	85	30
Downy Brome	0	20	65	0
Giant foxtail	90	100	100	20
Italn Ryegrass	30	70	80	0
Johnsongrass	25	10	35	20
Lambsquarter	100	95	95	95
Morningglory	60	70	70	30
Rape	25	0	90	70
Redroot Pigweed	100	80	50	10
Soybean	0	20	40	35
Speedwell	100	60	40	60
Sugar beet	95	95	100	90
Velvetleaf	80	50	60	15
Wheat	0	0	25	0
Wild buckwheat	70	30	0	20
Wild oat	10	20	70	10

TABLE C POSTEMERGENCE

Rate 62 g/ha	COMPOUND 1	3	4	6	7	8	9	10	14	18	22	23	24	25	26	28	29	30	31	32	34	35
Barley Igri	35	20	10	70	20	35	40	35	20	25	-	35	0	-	10	-	0	10	-	0	45	30
Barnyardgr Flood	60	75	85	65	80	65	65	70	75	70	70	75	80	60	70	60	70	70	50	40	85	90
Barnyardgrass	50	50	60	55	60	50	50	45	45	35	-	55	45	-	80	-	45	50	-	0	50	70
Bedstraw	-	45	75	35	30	40	60	60	80	75	-	70	65	-	65	-	35	45	-	30	70	60
Blackgrass	50	65	90	30	45	25	40	50	35	30	-	50	30	-	25	-	10	65	-	40	30	50
Chickweed	40	55	30	80	10	10	40	50	40	70	-	40	85	-	90	-	40	65	-	0	30	35
Cocklebur	20	0	30	50	0	0	40	20	35	0	-	50	70	-	90	-	0	30	-	0	0	0
Corn	45	50	60	40	50	50	30	20	35	30	-	30	35	-	40	-	20	20	-	0	50	50
Cotton	30	25	35	80	10	30	55	70	70	50	-	-	90	-	35	-	60	90	-	0	40	40
Crabgrass	40	35	70	35	35	40	35	40	50	40	-	20	40	-	50	-	45	45	-	0	40	70
Downy Brome	20	0	0	0	10	0	10	10	20	0	-	10	0	-	0	-	0	0	-	0	35	30
Duck salad	30	70	85	-	25	35	40	45	50	35	55	80	90	35	15	40	70	75	50	65	25	85
Giant foxtail	80	45	80	90	20	50	65	65	75	60	-	50	40	-	50	-	40	60	-	20	50	65
Italn Ryegrass	40	80	40	80	30	40	35	40	60	50	-	65	20	-	30	-	25	45	-	0	70	70
Johnsongrass	20	45	45	30	50	50	35	30	40	35	-	60	30	-	70	-	40	40	-	40	40	80
Lambsquarter	60	85	90	100	0	40	40	60	70	20	-	90	95	-	100	-	60	-	-	0	40	70
Morningglory	40	40	70	35	30	20	60	60	80	60	-	60	75	-	90	-	60	70	-	30	40	80
Rape	40	0	30	65	0	0	55	20	20	20	-	70	20	-	95	-	0	70	-	60	20	80
Redroot Pigweed	50	65	70	70	40	70	-	-	80	80	-	90	80	-	75	-	-	-	-	-	50	80
Rice Japonica	45	85	75	40	65	60	60	50	70	55	50	65	45	10	50	65	40	30	35	25	80	85
Soybean	30	50	30	40	35	50	90	90	70	70	-	60	75	-	80	-	80	80	-	40	80	90
Speedwell	40	50	85	90	50	10	50	85	90	100	-	95	-	-	95	-	65	100	-	0	-	70
Sugar beet	80	20	85	90	80	90	70	70	70	90	-	85	90	-	90	-	65	90	-	60	50	80
Umbrella sedge	90	50	80	50	40	30	65	70	55	70	90	80	95	45	90	90	80	80	50	85	10	85
Velvetleaf	20	25	30	35	20	20	50	50	50	30	-	25	35	-	50	-	30	20	-	30	-	40
Watergrass 2	50	80	80	35	65	50	65	45	60	70	80	70	90	40	70	90	75	65	65	70	85	95
Wheat	30	10	10	25	40	0	0	10	0	15	-	20	0	-	0	-	0	0	-	0	20	20
Wild buckwheat	60	80	70	20	20	35	50	65	40	70	-	30	35	-	70	-	30	70	-	70	30	50
Wild oat	30	80	45	70	50	35	45	50	50	45	-	35	40	-	80	-	35	60	-	70	60	70

TABLE C POSTEMERGENCE

Rate 62 g/ha	COMPOUND 36	37	38	39	40	41	42	49	50	51	52	53	55	58	61	63	68	69	71	73	74	77
Barley Igri	15	40	30	35	0	0	0	30	40	25	0	20	0	10	20	0	0	40	0	60	0	-
Barnyardgr Flood	70	65	50	75	65	60	30	20	85	15	70	65	55	10	20	25	70	65	0	85	40	70
Barnyardgrass	60	75	80	50	50	30	10	10	90	30	30	50	15	30	10	25	40	90	0	90	40	20
Bedstraw	35	65	40	85	0	10	10	20	60	40	50	45	50	60	40	0	85	60	30	80	20	-
Blackgrass	20	40	65	40	40	10	0	20	60	25	10	65	30	30	25	20	65	60	10	95	30	-
Chickweed	30	40	60	35	90	30	15	10	65	40	80	65	70	75	70	20	25	30	40	85	50	-
Cocklebur	0	30	0	80	10	35	0	30	80	40	45	0	50	60	0	95	50	65	30	65	50	60
Corn	30	40	40	20	10	0	0	10	25	25	10	10	25	0	10	0	25	35	0	60	30	0
Cotton	40	90	85	90	25	0	0	90	95	90	85	80	90	80	85	90	100	90	35	95	90	90
Crabgrass	30	70	50	35	70	30	10	20	70	25	35	30	25	25,	20	0	30	55	10	50	30	25
Downy Brome	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	25	0	-
Duck salad	50	50	30	50	20	0	0	0	100	15	-	-	-	0	0	0	10	85	0	90	40	30
Giant foxtail	50	85	90	55	50	15	10	15	80	30	45	20	20	45	15	25	30	50	0	40	10	75
Italn Ryegrass	40	90	70	70	20	10	0	0	70	0	50	0	0	0	10	0	30	50	0	75	0	-
Johnsongrass	50	70	70	35	10	25	0	0	30	40	20	30	20	20	10	0	35	30	30	50	10	20
Lambsquarter	40	75	65	95	0	10	15	90	95	75	90	95	90	70	70	70	95	85	0	95	90	-
Morningglory	40	80	80	70	30	25	25	80	90	50	80	80	70	80	25	100	35	70	20	70	30	60
Rape	40	80	10	75	30	10	10	20	65	20	70	80	80	70	90	70	100	65	30	90	50	-
Redroot Pigweed	80	70	70	80	40	40	15	45	80	55	65	50	90	50	70	70	90	60	35	65	50	70
Rice Japonica	70	70	60	65	25	0	0	15	65	15	45	15	10	10	0	0	60	25	0	70	0	30
Soybean	75	70	70	60	10	0	0	40	90	70	45	65	40	80	35	35	70	90	25	90	70	80
Speedwell	50	100	100	95	100	20	10	60	100	50	90	40	100	90	100	50	100	-	40	100	60	-
Sugar beet	80	60	80	90	70	0	0	60	90	80	85	90	100	75	90	90	95	65	0	65	70	-
Umbrella sedge	50	60	30	80	60	65	20	0	100	95	75	30	55	50	40	45	90	80	0	85	80	40
Velvetleaf	20	45	40	50	35	20	10	30	80	65	50	35	50	35	30	75	80	70	15	75	15	70
Watergrass 2	85	50	80	70	75	60	10	0	85	15	60	25	45	15	0	0	70	40	0	85	30	45
Wheat	0	20	10	10	0	0	0	10	10	20	0	0	0	0	0	0	20	30	10	70	30	-
Wild buckwheat	30	65	80	25	10	15	0	0	35	25	20	20	65	35	60	80	25	10	0	65	0	-
Wild oat	40	80	80	40	20	15	10	10	70	30	35	55	20	10	15	0	45	60	0	85	0	-

TABLE C	COMPOUND			
Rate 62 g/ha	112	114	115	133
POSTEMERGENCE				
Barley Igri	0	0	20	0
Barnyardgr Flood	65	50	75	20
Barnyardgrass	50	0	65	10
Bedstraw	30	40	90	10
Blackgrass	-	0	45	0
Chickweed	25	40	60	35
Cocklebur	10	40	30	40
Corn	15	0	0	0
Cotton	95	50	70	40
Crabgrass	10	40	40	10
Downy Brome	0	0	0	10
Duck salad	35	30	90	20
Giant foxtail	10	30	60	0
Italn Ryegrass	25	0	35	0
Johnsongrass	20	20	20	0
Lambsquarter	95	70	90	90
Morningglory	85	40	40	50
Rape	50	65	80	10
Redroot Pigweed	85	90	80	60
Rice Japonica	25	35	80	40
Soybean	70	60	60	70
Speedwell	85	55	45	25
Sugar beet	70	70	80	60
Umbrella sedge	80	90	95	0
Velvetleaf	50	20	30	35
Watergrass 2	40	40	70	10
Wheat	10	0	0	0
Wild buckwheat	0	35	0	30
Wild oat	15	10	60	0

TABLE C

Rate 62 g/ha	COMPOUND 1	3	4	6	7	8	9	10	14	18	23	24	26	29	30	32	34	35	36	37	38	39
PREEMERGENCE																						
Barley Igri	70	90	70	80	80	45	35	65	50	35	0	0	0	0	0	0	60	45	0	60	70	0
Barnyardgrass	85	90	95	90	80	80	90	90	80	75	50	60	35	50	70	0	90	90	70	90	100	70
Bedstraw	60	100	100	0	80	10	0	0	40	10	20	30	65	35	25	0	20	95	10	60	100	0
Blackgrass	60	90	100	80	90	70	50	60	50	40	35	60	25	10	15	40	0	60	60	40	70	45
Chickweed	75	95	50	30	70	0	95	65	10	90	30	60	75	20	25	0	95	95	0	95	95	95
Cocklebur	0	0	40	35	0	0	30	30	20	20	20	0	0	10	10	0	0	10	0	30	10	30
Corn	75	40	85	80	75	60	70	65	60	40	10	30	0	0	30	0	55	55	45	60	65	25
Cotton	15	20	0	10	0	0	0	-	-	10	10	0	0	0	0	0	10	20	20	10	50	30
Crabgrass	85	95	100	90	60	85	100	100	100	90	75	70	90	95	85	20	100	95	100	100	100	90
Downy Brome	35	80	45	55	30	0	50	20	25	10	0	0	10	0	0	0	85	10	10	35	80	30
Giant foxtail	100	100	100	90	65	90	90	75	90	90	70	40	90	55	75	10	90	100	100	100	100	60
Italn Ryegrass	70	95	90	80	90	70	80	85	90	80	70	50	40	10	30	0	85	95	75	85	90	80
Johnsongrass	75	80	95	75	90	50	85	80	70	70	50	40	30	50	65	0	70	85	80	90	90	70
Lambsquarter	95	100	100	100	20	60	95	95	95	95	100	95	95	90	95	20	95	100	100	95	95	95
Morningglory	40	90	75	35	10	30	20	30	30	40	40	50	30	50	50	0	50	95	50	75	100	70
Rape	10	40	75	10	0	0	10	0	0	0	0	0	10	0	10	10	0	30	10	95	40	0
Redroot Pigweed	70	90	65	90	0	20	40	70	50	70	60	75	100	95	100	-	95	100	100	100	100	100
Soybean	40	80	70	70	35	10	40	20	20	10	20	0	-	0	0	0	10	80	40	60	85	20
Speedwell	75	100	100	45	70	20	40	90	100	95	95	100	95	-	90	50	30	100	100	100	100	100
Sugar beet	65	100	100	80	25	20	10	25	25	10	35	100	95	-	100	35	100	100	100	100	100	100
Velvetleaf	80	100	100	40	30	70	70	30	40	20	20	75	20	20	70	25	65	80	85	100	100	90
Wheat	80	95	95	75	90	25	10	80	30	25	0	0	0	0	0	0	40	40	0	90	85	0
Wild buckwheat	50	90	100	75	10	10	0	0	20	10	0	85	20	10	40	50	25	90	25	95	100	75
Wild oat	85	90	95	70	90	75	80	70	70	60	35	10	0	0	0	20	80	70	70	75	75	40

TABLE C

Rate 62 g/ha	COMPOUND																					
	40	41	42	49	50	51	52	53	55	58	61	63	68	69	71	73	74	77	112	114	115	133
PREEMERGENCE																						
Barley Igri	65	0	0	10	70	10	10	40	30	0	0	0	-	-	-	-	-	10	10	0	40	0
Barnyardgrass	75	40	50	10	95	45	90	90	55	65	50	35	60	90	0	95	70	85	40	65	80	10
Bedstraw	0	0	0	0	85	0	60	0	0	25	0	0	-	-	-	-	-	0	30	0	40	0
Blackgrass	55	10	20	25	75	30	75	85	70	25	0	0	-	-	-	-	-	70	85	30	45	0
Chickweed	60	10	30	0	70	0	10	10	80	70	85	0	-	-	-	-	-	40	90	0	70	0
Cocklebur	10	0	0	0	65	0	0	10	0	0	0	20	0	10	0	65	-	0	0	0	0	10
Corn	20	35	0	0	65	20	30	35	0	20	0	0	15	45	0	70	20	35	20	-	0	0
Cotton	0	0	0	0	70	0	0	0	10	0	0	0	20	0	0	80	20	0	0	0	20	-
Crabgrass	90	90	100	10	100	30	100	95	75	90	35	20	10	70	0	100	20	95	10	20	70	30
Downy Brome	60	10	10	10	20	0	20	25	0	0	0	0	-	-	-	-	-	25	0	20	35	0
Giant foxtail	90	100	100	35	100	60	35	65	35	100	85	30	30	35	0	100	10	85	90	80	100	10
Italn Ryegrass	85	20	10	20	80	25	75	80	10	25	0	0	-	-	-	-	-	20	30	45	70	0
Johnsongrass	35	40	0	0	50	10	55	50	10	0	10	35	10	35	0	70	20	30	15	10	20	10
Lambsquarter	100	10	85	40	100	0	95	95	100	95	95	0	-	-	-	-	-	0	30	95	95	95
Morningglory	40	25	20	0	100	20	70	30	35	20	10	35	30	50	0	90	0	15	30	40	45	10
Rape	45	0	0	0	100	0	10	20	0	30	20	60	-	-	-	-	-	20	10	0	90	40
Redroot Pigweed	90	80	20	40	100	55	80	40	95	90	90	30	100	85	0	95	20	25	90	80	30	0
Soybean	0	0	0	0	90	20	10	25	0	60	10	0	0	50	0	90	20	20	0	10	40	30
Speedwell	100	30	30	0	100	25	100	80	100	85	80	0	-	-	-	-	-	20	35	60	40	50
Sugar beet	60	80	0	10	100	20	100	80	100	100	0	0	-	-	-	-	-	30	90	95	90	0
Velvetleaf	20	30	0	0	90	0	50	30	40	50	30	45	40	50	0	100	20	30	50	30	30	0
Wheat	65	20	0	0	65	0	10	0	20	10	0	0	-	-	-	-	-	0	0	0	25	0
Wild buckwheat	30	0	0	0	30	0	20	35	0	10	0	0	-	-	-	-	-	10	40	0	0	10
Wild oat	65	0	0	0	75	0	50	70	10	0	0	0	-	-	-	-	-	30	10	0	50	0

TABLE C POSTEMERGENCE

Rate 31 g/ha	COMPOUND 1	3	4	7	8	9	10	14	18	22	24	25	26	28	29	30	31	32	34	35	36	37
Barley Igri	0	0	0	20	20	30	25	10	10	-	0	-	0	-	0	0	-	0	30	30	10	40
Barnyardgr Flood	40	65	70	75	50	50	50	60	60	45	70	40	60	60	60	35	45	25	80	85	65	25
Barnyardgrass	30	20	25	40	40	35	35	40	30	-	35	-	30	-	35	30	-	0	40	70	30	35
Bedstraw	-	30	60	20	40	50	50	70	70	-	40	-	60	-	35	45	-	0	40	60	30	65
Blackgrass	30	50	70	45	25	20	35	25	20	-	20	-	25	-	10	40	-	35	10	30	0	30
Chickweed	40	50	30	10	10	30	30	30	50	-	40	-	80	-	35	65	-	0	10	30	25	40
Cocklebur	10	0	20	0	0	40	20	25	0	-	70	-	60	-	0	30	-	0	0	0	0	30
Corn	25	40	50	30	25	20	10	20	20	-	20	-	20	-	10	15	-	0	40	30	10	30
Cotton	30	20	35	0	-	50	60	40	40	-	90	-	20	-	60	60	-	0	40	30	40	80
Crabgrass	25	25	40	35	10	25	30	30	20	-	30	-	30	-	35	20	-	0	30	60	-	40
Downy Brome	10	0	0	0	0	0	0	10	0	-	0	-	0	-	0	0	-	0	25	10	0	0
Duck salad	10	60	50	0	35	30	30	30	30	40	60	30	10	30	60	65	30	50	10	60	30	40
Giant foxtail	55	40	45	20	50	55	60	50	40	-	25	-	30	-	30	50	-	10	30	65	50	60
Italn Ryegrass	20	10	10	0	20	10	10	30	40	-	20	-	0	-	0	0	-	0	55	50	30	20
Johnsongrass	10	35	40	35	35	10	10	20	20	-	30	-	20	-	40	35	-	40	40	40	20	40
Lambsquarter	60	85	65	0	25	40	30	55	10	-	-	-	95	-	45	70	-	0	40	60	40	70
Morningglory	40	35	65	20	20	40	40	75	60	-	65	-	90	-	60	65	-	20	-	75	40	70
Rape	35	0	25	0	0	50	10	0	20	-	20	-	70	-	0	65	-	0	0	65	30	80
Redroot Pigweed	35	45	70	30	60	70	70	80	70	-	-	-	-	-	60	60	-	-	40	80	80	50
Rice Japonica	25	70	60	20	40	30	30	45	50	30	30	10	20	40	30	20	30	25	70	75	65	25
Soybean	30	50	30	25	50	75	75	60	-	-	75	-	70	-	60	70	-	35	80	90	70	70
Speedwell	40	50	65	30	10	40	45	70	90	-	75	-	95	-	65	90	-	0	-	-	-	95
Sugar beet	50	20	70	20	90	50	60	70	90	-	90	-	85	-	60	35	-	60	40	80	70	60
Umbrella sedge	60	40	70	20	10	55	50	45	40	90	85	40	70	80	70	80	50	70	0	80	40	55
Velvetleaf	10	15	30	20	20	40	35	30	25	-	35	-	25	-	20	10	-	20	40	35	20	35
Watergrass 2	40	65	65	65	45	30	25	30	40	30	75	40	65	80	70	25	30	35	85	90	50	30
Wheat	0	0	0	30	0	0	0	0	10	-	0	-	0	-	0	0	-	0	0	0	0	0
Wild buckwheat	45	0	40	10	35	40	50	40	50	-	20	-	40	-	30	40	-	70	20	40	30	35
Wild oat	30	30	25	20	35	40	35	40	35	-	40	-	50	-	35	30	-	60	60	50	35	40

TABLE C	COMPOUND						
Rate 31 g/ha	38	39	40	41	49	50	51
POSTEMERGENCE							
Barley Igri	10	30	0	0	20	30	20
Barnyardgr Flood	30	60	55	40	15	65	10
Barnyardgrass	35	40	20	20	0	90	30
Bedstraw	40	80	0	0	20	50	25
Blackgrass	40	35	40	0	10	30	10
Chickweed	55	35	85	30	0	30	40
Cocklebur	0	75	0	30	30	80	40
Corn	30	10	10	0	0	10	20
Cotton	85	90	25	0	90	90	80
Crabgrass	50	25	45	20	20	70	20
Downy Brome	0	0	0	0	0	0	0
Duck salad	25	40	20	0	0	70	10
Giant foxtail	70	35	45	10	15	70	20
Italn Ryegrass	60	40	10	0	0	0	0
Johnsongrass	40	30	0	15	0	20	35
Lambsquarter	50	95	0	0	20	80	70
Morningglory	80	70	30	25	70	90	35
Rape	0	65	30	0	10	65	20
Redroot Pigweed	60	80	-	20	45	75	35
Rice Japonica	20	50	-	0	0	50	10
Soybean	70	60	0	0	40	90	50
Speedwell	50	70	100	10	55	100	50
Sugar beet	45	90	70	0	60	65	55
Umbrella sedge	0	80	40	40	0	100	10
Velvetleaf	40	35	30	10	20	60	45
Watergrass 2	20	70	45	30	0	65	0
Wheat	0	10	0	0	0	10	0
Wild buckwheat	20	20	0	10	0	0	0
Wild oat	45	30	0	15	10	50	0

TABLE C

Rate 31 g/ha	COMPOUND 1	3	4	7	8	9	10	14	18	24	26	29	30	32	34	35	36	37	38	39	40	41
PREEMERGENCE																						
Barley Igri	50	85	10	60	30	25	40	25	10	0	0	0	0	0	30	0	0	40	45	0	40	0
Barnyardgrass	80	20	90	70	40	65	80	65	65	40	20	40	40	0	55	70	55	60	70	50	40	40
Bedstraw	20	95	70	10	0	0	0	0	10	30	20	35	25	0	10	30	10	60	85	0	0	0
Blackgrass	25	80	90	65	20	50	50	30	30	25	10	0	0	10	0	60	25	20	60	35	45	10
Chickweed	0	95	50	50	0	10	0	0	70	10	0	0	0	0	0	90	0	95	95	95	40	0
Cocklebur	0	0	15	0	0	10	10	10	20	0	-	0	10	0	0	10	0	10	0	20	0	0
Corn	65	20	80	40	50	60	55	45	20	10	0	0	20	0	40	45	15	35	45	25	0	0
Cotton	10	10	0	0	0	0	0	10	10	0	0	0	0	0	-	20	20	0	20	20	0	0
Crabgrass	70	75	100	60	65	95	85	80	70	40	50	80	80	20	95	95	85	40	100	50	80	90
Downy Brome	25	60	35	10	0	10	0	10	0	0	10	0	0	0	10	0	0	30	30	10	25	0
Giant foxtail	45	70	100	50	65	70	55	65	70	20	20	10	30	0	70	100	60	90	100	40	70	100
Italn Ryegrass	45	85	70	75	10	70	85	85	50	35	0	0	30	0	30	90	70	80	75	75	65	10
Johnsongrass	60	40	90	80	30	75	40	40	60	20	30	40	30	0	60	65	60	90	90	50	20	10
Lambsquarter	95	100	100	20	60	90	90	95	35	95	95	60	90	20	95	100	95	95	-	95	100	10
Morningglory	20	50	40	0	20	20	0	20	30	30	30	30	25	0	0	75	35	40	90	65	30	20
Rape	0	0	10	0	0	10	0	0	0	0	0	0	10	0	0	10	0	20	10	0	15	0
Redroot Pigweed	20	75	30	0	20	40	60	30	50	-	60	95	30	-	75	100	90	100	100	100	60	50
Soybean	25	35	50	10	0	30	20	0	10	0	0	0	0	0	10	65	20	25	40	20	0	0
Speedwell	70	90	100	10	20	40	60	90	75	100	85	-	-	20	20	100	30	95	100	95	95	10
Sugar beet	20	30	100	10	10	10	25	25	10	100	85	20	60	0	100	100	100	95	100	100	60	10
Velvetleaf	20	20	35	25	50	20	0	10	10	35	0	0	0	0	20	65	25	40	80	75	10	20
Wheat	40	90	80	80	0	10	20	0	20	0	0	0	0	0	10	10	0	60	30	0	20	0
Wild buckwheat	0	90	65	0	10	0	0	10	10	10	0	0	0	0	0	85	0	20	40	30	10	0
Wild oat	50	90	70	90	70	40	60	60	40	0	0	0	0	20	70	60	40	45	65	20	25	0

TABLE C	COMPOUND		
Rate 31 g/ha	49	50	51
PREEMERGENCE			
Barley Igri	10	65	0
Barnyardgrass	0	90	45
Bedstraw	0	80	0
Blackgrass	10	50	20
Chickweed	0	70	0
Cocklebur	0	65	0
Corn	0	55	10
Cotton	0	10	0
Crabgrass	0	80	20
Downy Brome	10	0	0
Giant foxtail	20	100	35
Italn Ryegrass	20	60	0
Johnsongrass	0	30	10
Lambsquarter	20	100	0
Morningglory	0	90	0
Rape	0	95	0
Redroot Pigweed	15	100	50
Soybean	0	75	10
Speedwell	0	95	0
Sugar beet	10	100	0
Velvetleaf	0	90	0
Wheat	0	20	0
Wild buckwheat	0	10	0
Wild oat	0	70	0

TABLE C	COMPOUND	
Rate 16 g/ha	37	38
POSTEMERGENCE		
Barley Igri	40	10
Barnyardgr Flood	0	0
Barnyardgrass	20	20
Bedstraw	65	40
Blackgrass	30	30
Chickweed	40	40
Cocklebur	10	0
Corn	20	20
Cotton	70	85
Crabgrass	40	30
Downy Brome	0	0
Duck salad	35	20
Giant foxtail	50	40
Italn Ryegrass	0	0
Johnsongrass	20	20
Lambsquarter	65	45
Morningglory	60	70
Rape	20	0
Redroot Pigweed	50	40
Rice Japonica	25	0
Soybean	70	60
Speedwell	50	35
Sugar beet	60	40
Umbrella sedge	0	0
Velvetleaf	30	30
Watergrass 2	20	10
Wheat	0	0
Wild buckwheat	35	10
Wild oat	20	20

TABLE C	COMPOUND	
Rate 16 g/ha	37	38
PREEMERGENCE		
Barley Igri	20	0
Barnyardgrass	40	50
Bedstraw	0	25
Blackgrass	10	10
Chickweed	90	90
Cocklebur	0	0
Corn	0	10
Cotton	0	0
Crabgrass	40	40
Downy Brome	30	20
Giant foxtail	60	90
Italn Ryegrass	0	60
Johnsongrass	30	50
Lambsquarter	95	90
Morningglory	10	30
Rape	10	0
Redroot Pigweed	100	90
Soybean	0	20
Speedwell	90	95
Sugar beet	95	100
Velvetleaf	10	30
Wheat	0	0
Wild buckwheat	0	30
Wild oat	25	0

TEST D

Seeds of barnyardgrass (*Echinochloa crus-galli*), bindweed (*Convolvulus arvensis*), black nightshade (*Solanum ptycanthum dunal*), cassia (*Cassia obtusifolia*), cocklebur (*Xanthium strumarium*), common ragweed (*Ambrosia artemisiifolia*), corn (*Zea mays*), cotton (*Gossypium hirsutum*), crabgrass (*Digitaria* spp.), fall panicum (*Panicum dichotomiflorum*), giant foxtail (*Setaria faberii*), green foxtail (*Setaria viridis*), jimsonweed (*Datura stramonium*), johnsongrass (*Sorghum halepense*), lambsquarter (*Chenopodium album*), morningglory (*Ipomoea* spp.), pigweed (*Amaranthus retroflexus*), prickly sida (*Sida spinosa*), shattercane (*Sorghum vulgare*), signalgrass (*Brachiaria platyphylla*), smartweed (*Polygonum pensylvanicum*), soybean (*Glycine max*), sunflower (*Helianthus annuus*), velvetleaf (*Abutilon theophrasti*), wild proso (*Panicum miliaceum*), woolly cupgrass (*Eriochloa villosa*), yellow foxtail (*Setaria lutescens*) and purple nutsedge (*Cyperus rotundus*) tubers were planted into a sandy loam or clay loam soil. These crops and weeds were grown in the greenhouse until the plants ranged in height from two to eighteen cm (one to four leaf stage), then treated postemergence with the test chemicals formulated in a non-phytotoxic solvent mixture which includes a surfactant. Pots receiving preemergence treatments were planted immediately prior to test chemical application. Pots treated in this fashion were placed in the greenhouse and maintained according to routine greenhouse procedures.

Treated plants and untreated controls were maintained in the greenhouse approximately 14-21 days after application of the test compound. Visual evaluations of plant injury responses were then recorded. Plant response ratings, summarized in Table D, are reported on a 0 to 100 scale where 0 is no effect and 100 is complete control.

TABLE D	COMPOUND	
Rate 560 g/ha	41	42
PREEMERGENCE		
SANDY LOAM SOIL		
Barnyardgrass	100	100
Bindweed	100	50
Blk Nightshade	100	80
Cassia	80	10
Cocklebur	70	10
Corn	90	60
Cotton	40	0
Crabgrass	100	100
Fall Panicum	100	100
Giant Foxtail	100	100
Green Foxtail	100	100
Jimsonweed	100	20
Johnson Grass	100	90
Lambsquarter	100	100
Morningglory	90	100
Nutsedge	95	50
Pigweed	100	100
Prickly Sida	100	0
Ragweed	100	80
Shattercane	95	100
Signalgrass	100	100
Smartweed	100	30
Soybean	30	0
Sunflower	90	10
Velvetleaf	100	100
Wild Proso	100	95
Woolly cupgrass	85	100
Yellow Foxtail	100	95

TABLE D	COMPOUND	
Rate 280 g/ha	41	42
PREEMERGENCE		
SANDY LOAM SOIL		
Barnyardgrass	100	100
Bindweed	100	40
Blk Nightshade	100	80
Cassia	10	0
Cocklebur	50	0
Corn	80	40
Cotton	10	0
Crabgrass	100	100
Fall Panicum	100	95
Giant Foxtail	100	100
Green Foxtail	100	100
Jimsonweed	90	0
Johnson Grass	90	60
Lambsquarter	100	100
Morningglory	50	100
Nutsedge	90	30
Pigweed	100	85
Prickly Sida	50	0
Ragweed	100	50
Shattercane	90	70
Signalgrass	100	100
Smartweed	100	0
Soybean	10	0
Sunflower	70	20
Velvetleaf	100	100
Wild Proso	90	85
Woolly cupgrass	70	80
Yellow Foxtail	100	100

TABLE D	COMPOUND		
Rate 140 g/ha	41	42	73
PREEMERGENCE			
SANDY LOAM SOIL			
Barnyardgrass	95	50	100
Bindweed	100	10	100
Blk Nightshade	95	50	95
Cassia	0	0	80
Cocklebur	30	0	40
Corn	80	20	70
Cotton	10	0	90
Crabgrass	100	100	100
Fall Panicum	100	90	100
Giant Foxtail	100	100	100
Green Foxtail	100	100	100
Jimsonweed	50	0	100
Johnson Grass	95	30	80
Lambsquarter	100	100	100
Morningglory	50	20	100
Nutsedge	80	30	90
Pigweed	100	40	100
Prickly Sida	10	0	100
Ragweed	95	0	100
Shattercane	90	30	90
Signalgrass	100	100	100
Smartweed	95	0	80
Soybean	0	0	95
Sunflower	30	10	70
Velvetleaf	100	100	100
Wild Proso	80	40	100
Woolly cupgrass	40	50	70
Yellow Foxtail	100	80	100

TABLE D	COMPOUND			
Rate 70 g/ha	4	41	42	73
PREEMERGENCE				
SANDY LOAM SOIL				
Barnyardgrass	85	80	10	100
Bindweed	20	100	0	80
Blk Nightshade	100	50	10	95
Cassia	20	0	0	80
Cocklebur	50	0	0	20
Corn	70	60	10	50
Cotton	30	0	0	10
Crabgrass	100	100	100	100
Fall Panicum	100	95	50	100
Giant Foxtail	100	100	100	100
Green Foxtail	100	100	100	100
Jimsonweed	100	10	0	100
Johnson Grass	100	80	10	50
Lambsquarter	100	100	100	100
Morningglory	50	40	0	70
Nutsedge	70	60	10	70
Pigweed	100	100	-	85
Prickly Sida	100	0	0	100
Ragweed	100	100	0	100
Shattercane	50	50	10	60
Signalgrass	95	95	95	80
Smartweed	20	100	0	40
Soybean	50	0	0	70
Sunflower	70	10	0	50
Velvetleaf	100	100	0	100
Wild Proso	90	40	10	100
Woolly cupgrass	90	10	10	70
Yellow Foxtail	90	90	50	100

TABLE D	COMPOUND		
Rate 35 g/ha	4	42	73
PREEMERGENCE			
SANDY LOAM SOIL			
Barnyardgrass	50	10	90
Bindweed	10	0	0
Blk Nightshade	95	10	95
Cassia	0	0	60
Cocklebur	20	0	10
Corn	60	10	40
Cotton	10	0	-
Crabgrass	100	100	100
Fall Panicum	100	10	100
Giant Foxtail	100	00	100
Green Foxtail	100	00	100
Jimsonweed	80	0	100
Johnson Grass	50	10	20
Lambsquarter	100	180	100
Morningglory	20	0	50
Nutsedge	40	0	50
Pigweed	90	1 0	80
Prickly Sida	80	0	70
Ragweed	100	0	50
Shattercane	50	10	50
Signalgrass	95	60	70
Smartweed	30	0	40
Soybean	40	0	50
Sunflower	20	0	50
Velvetleaf	100	0	100
Wild Proso	90	10	70
Woolly cupgrass	90	10	50
Yellow Foxtail	60	20	90

TABLE D	COMPOUND	
Rate 17 g/ha	4	73
SANDY LOAM SOIL		
PREEMERGENCE		
Barnyardgrass	30	30
Bindweed	10	0
Blk Nightshade	40	80
Cassia	0	0
Cocklebur	0	0
Corn	40	5
Cotton	0	0
Crabgrass	100	40
Fall Panicum	70	60
Giant Foxtail	90	60
Green Foxtail	60	50
Jimsonweed	10	70
Johnson Grass	30	0
Lambsquarter	50	100
Morningglory	-	0
Nutsedge	10	10
Pigweed	40	70
Prickly Sida	10	40
Ragweed	40	30
Shattercane	30	0
Signalgrass	70	50
Smartweed	0	0
Soybean	10	20
Sunflower	0	30
Velvetleaf	0	0
Wild Proso	30	30
Woolly cupgrass	30	0
Yellow Foxtail	40	50

TABLE D	COMPOUND	
Rate 8 g/ha	4	73
PREEMERGENCE		
SANDY LOAM SOIL		
Barnyardgrass	10	0
Bindweed	0	0
Blk Nightshade	0	0
Cassia	0	0
Cocklebur	0	0
Corn	10	0
Cotton	0	0
Crabgrass	10	0
Fall Panicum	10	50
Giant Foxtail	30	0
Green Foxtail	0	0
Jimsonweed	0	30
Johnson Grass	10	0
Lambsquarter	0	50
Morningglory	0	0
Nutsedge	0	0
Pigweed	0	30
Prickly Sida	0	0
Ragweed	0	0
Shattercane	0	0
Signalgrass	0	30
Smartweed	0	0
Soybean	0	0
Sunflower	0	0
Velvetleaf	0	0
Wild Proso	10	0
Woolly cupgrass	10	0
Yellow Foxtail	0	20

TABLE D	COMPOUND
Rate 560 g/ha	41
PREEMERGENCE	
CLAY LOAM SOIL	
Barnyardgrass	100
Bindweed	100
Blk Nightshade	100
Cassia	0
Cocklebur	5
Corn	100
Cotton	10
Crabgrass	100
Fall Panicum	100
Giant Foxtail	100
Green Foxtail	100
Jimsonweed	100
Johnson Grass	100
Lambsquarter	100
Morningglory	70
Nutsedge	10
Pigweed	100
Prickly Sida	30
Ragweed	100
Shattercane	90
Signalgrass	100
Smartweed	100
Soybean	0
Sunflower	90
Velvetleaf	95
Wild Proso	100
Woolly cupgrass	60
Yellow Foxtail	100

TABLE D	COMPOUND
Rate 280 g/ha	41
PREEMERGENCE	
CLAY LOAM SOIL	
Barnyardgrass	70
Bindweed	100
Blk Nightshade	100
Cassia	0
Cocklebur	0
Corn	70
Cotton	0
Crabgrass	100
Fall Panicum	100
Giant Foxtail	100
Green Foxtail	100
Jimsonweed	80
Johnson Grass	60
Lambsquarter	100
Morningglory	70
Nutsedge	0
Pigweed	100
Prickly Sida	30
Ragweed	90
Shattercane	80
Signalgrass	100
Smartweed	100
Soybean	0
Sunflower	80
Velvetleaf	70
Wild Proso	70
Woolly cupgrass	50
Yellow Foxtail	100

TABLE D	COMPOUND
Rate 140 g/ha	41
PREEMERGENCE	
CLAY LOAM SOIL	
Barnyardgrass	60
Bindweed	80
Blk Nightshade	100
Cassia	0
Cocklebur	0
Corn	60
Cotton	-
Crabgrass	100
Fall Panicum	90
Giant Foxtail	100
Green Foxtail	100
Jimsonweed	80
Johnson Grass	55
Lambsquarter	100
Morningglory	5
Nutsedge	0
Pigweed	100
Prickly Sida	10
Ragweed	90
Shattercane	20
Signalgrass	100
Smartweed	100
Soybean	0
Sunflower	40
Velvetleaf	0
Wild Proso	20
Woolly cupgrass	40
Yellow Foxtail	-

TABLE D	COMPOUND
Rate 70 g/ha	41
PREEMERGENCE	
CLAY LOAM SOIL	
Barnyardgrass	30
Bindweed	80
Blk Nightshade	100
Cassia	0
Cocklebur	0
Corn	50
Cotton	0
Crabgrass	100
Fall Panicum	90
Giant Foxtail	100
Green Foxtail	100
Jimsonweed	40
Johnson Grass	20
Lambsquarter	100
Morningglory	5
Nutsedge	0
Pigweed	100
Prickly Sida	0
Ragweed	45
Shattercane	10
Signalgrass	90
Smartweed	100
Soybean	0
Sunflower	40
Velvetleaf	0
Wild Proso	20
Woolly cupgrass	0
Yellow Foxtail	100

TABLE D	COMPOUND
Rate 35 g/ha	41
PREEMERGENCE	
CLAY LOAM SOIL	
Barnyardgrass	20
Bindweed	20
Blk Nightshade	80
Cassia	0
Cocklebur	0
Corn	10
Cotton	-
Crabgrass	100
Fall Panicum	70
Giant Foxtail	80
Green Foxtail	70
Jimsonweed	0
Johnson Grass	20
Lambsquarter	100
Morningglory	0
Nutsedge	0
Pigweed	100
Prickly Sida	0
Ragweed	40
Shattercane	10
Signalgrass	70
Smartweed	0
Soybean	0
Sunflower	0
Velvetleaf	0
Wild Proso	0
Woolly cupgrass	0
Yellow Foxtail	70

TEST E

Compounds evaluated in this test were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied to the soil surface before plant seedlings emerged (preemergence application) and to plants that were grown for various periods of time before treatment (postemergence application). A sandy loam soil was used for the preemergence test while a mixture of sandy loam soil and greenhouse potting mix in a 60:40 ratio was used for the postemergence test. Test compounds were applied within approximately one day after planting seeds for the preemergence test. Plantings of these crops and weed species were adjusted to produce plants of appropriate size for the postemergence test. All plant species were grown using normal greenhouse practices. Crop and weed species include american black nightshade (*Solanum americanum*), arrowleaf sida (*Sida rhombifolia*), barnyardgrass (*Echinochloa crus-galli*), cocklebur (*Xanthium strumarium*), common lambsquarters (*Chenopodium album*), common ragweed (*Ambrosia artemisiifolia*), corn (*Zea mays*), cotton (*Gossypium hirsutum*), eastern black nightshade (*Solanum ptycanthum*), fall panicum (*Panicum dichotomiflorum*), field bindweed (*Convolvulus arvensis*), Florida beggarweed (*Desmodium purpureum*), giant foxtail (*Setaria faberii*), hairy beggarticks (*Bidens pilosa*), ivyleaf morningglory (*Ipomoea hederacea*), johnsongrass (*Sorghum halepense*), ladysthumb (*Polygonum persicaria*), large crabgrass (*Digitaria sanguinalis*), purple nutsedge (*Cyperus rotundus*), redroot pigweed (*Amaranthus retroflexus*), soybean (*Glycine max*), surinam grass (*Brachiaria decumbens*), velvetleaf (*Abutilon theophrasti*) and wild poinsettia (*Euphorbia heterophylla*).

Treated plants and untreated controls were maintained in a greenhouse for approximately 14 to 21 days, after which all treated plants were compared to untreated controls and visually evaluated. Plant response ratings, summarized in Table E, are based upon a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash response (-) means no test result.

TABLE E	COMPOUND
Rate 280 g/ha	41
POSTEMERGENCE	
Arrowleaf Sida	35
Barnyardgrass	30
Cocklebur	25
Common Ragweed	35
Corn	0
Cotton	40
Estrn Blknight	40
Fall Panicum	35
Field Bindweed	30
Fl Beggarweed	25
Giant Foxtail	25
Hairy Beggartic	45
Ivyleaf Mrnglry	25
Johnsongrass	15
Ladysthumb	55
Lambsquarters	15
Large Crabgrass	80
Purple Nutsedge	0
Redroot Pigweed	45
Soybean	20
Surinam Grass	25
Velvetleaf	20
Wild Poinsettia	20

TABLE E	COMPOUND
Rate 280 g/ha	41
PREEMERGENCE	
Arrowleaf Sida	75
Barnyardgrass	95
Cocklebur	20
Common Ragweed	90
Corn	65
Cotton	-
Fall Panicum	95
Field Bindweed	95
Fl Beggarweed	0
Giant Foxtail	100
Hairy Beggartic	80
Ivyleaf Mrnglry	60
Johnsongrass	85
Ladysthumb	100
Lambsquarters	100
Large Crabgrass	100
Purple Nutsedge	-
Redroot Pigweed	100
Soybean	-
Surinam Grass	100
Velvetleaf	25
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 140 g/ha	41
POSTEMERGENCE	
Arrowleaf Sida	20
Barnyardgrass	20
Cocklebur	-
Common Ragweed	20
Corn	0
Cotton	35
Estrn Blknight	20
Fall Panicum	30
Field Bindweed	25
Fl Beggarweed	15
Giant Foxtail	15
Hairy Beggartic	35
Ivyleaf Mrnglry	15
Johnsongrass	10
Ladysthumb	25
Lambsquarters	0
Large Crabgrass	50
Purple Nutsedge	0
Redroot Pigweed	35
Soybean	15
Surinam Grass	20
Velvetleaf	15
Wild Poinsettia	15

TABLE E	COMPOUND
Rate 140 g/ha	41
PREEMERGENCE	
Arrowleaf Sida	30
Barnyardgrass	85
Cocklebur	0
Common Ragweed	90
Corn	50
Cotton	-
Fall Panicum	-
Field Bindweed	55
Fl Beggarweed	0
Giant Foxtail	100
Hairy Beggartic	65
Ivyleaf Mrnglry	10
Johnsongrass	65
Ladysthumb	85
Lambsquarters	95
Large Crabgrass	100
Purple Nutsedge	45
Redroot Pigweed	100
Soybean	0
Surinam Grass	100
Velvetleaf	0
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 70 g/ha	41
POSTEMERGENCE	
Arrowleaf Sida	10
Barnyardgrass	10
Cocklebur	10
Common Ragweed	15
Corn	0
Cotton	30
Estrn Blknight	10
Fall Panicum	10
Field Bindweed	10
Fl Beggarweed	0
Giant Foxtail	10
Hairy Beggartic	30
Ivyleaf Mrnglry	0
Johnsongrass	0
Ladysthumb	0
Lambsquarters	0
Large Crabgrass	25
Purple Nutsedge	0
Redroot Pigweed	25
Soybean	0
Surinam Grass	15
Velvetleaf	10
Wild Poinsettia	10

TABLE E	COMPOUND
Rate 70 g/ha	41
PREEMERGENCE	
Arrowleaf Sida	15
Barnyardgrass	75
Cocklebur	0
Common Ragweed	45
Corn	0
Cotton	0
Fall Panicum	80
Field Bindweed	0
Fl Beggarweed	-
Giant Foxtail	90
Hairy Beggartic	25
Ivyleaf Mrnglry	0
Johnsongrass	15
Ladysthumb	55
Lambsquarters	85
Large Crabgrass	100
Purple Nutsedge	40
Redroot Pigweed	100
Soybean	0
Surinam Grass	55
Velvetleaf	0
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 35 g/ha	41
POSTEMERGENCE	
Arrowleaf Sida	0
Barnyardgrass	0
Cocklebur	0
Common Ragweed	10
Corn	0
Cotton	10
Estrn Blknight	0
Fall Panicum	0
Field Bindweed	0
Fl Beggarweed	0
Giant Foxtail	0
Hairy Beggartic	25
Ivyleaf Mrnglry	0
Johnsongrass	0
Ladysthumb	0
Lambsquarters	0
Large Crabgrass	10
Purple Nutsedge	0
Redroot Pigweed	15
Soybean	0
Surinam Grass	10
Velvetleaf	0
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 35 g/ha	41
PREEMERGENCE	
Arrowleaf Sida	0
Barnyardgrass	65
Cocklebur	0
Common Ragweed	30
Corn	0
Cotton	0
Fall Panicum	60
Field Bindweed	0
Fl Beggarweed	-
Giant Foxtail	90
Hairy Beggartic	0
Ivyleaf Mrnglry	0
Johnsongrass	15
Ladysthumb	-
Lambsquarters	20
Large Crabgrass	95
Purple Nutsedge	35
Redroot Pigweed	95
Soybean	0
Surinam Grass	15
Velvetleaf	0
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 17 g/ha	41
POSTEMERGENCE	
Arrowleaf Sida	0
Barnyardgrass	0
Cocklebur	0
Common Ragweed	5
Corn	0
Cotton	0
Estrn Blknight	0
Fall Panicum	0
Field Bindweed	0
Fl Beggarweed	0
Giant Foxtail	0
Hairy Beggartic	15
Ivyleaf Mrnglry	0
Johnsongrass	0
Ladysthumb	0
Lambsquarters	0
Large Crabgrass	0
Purple Nutsedge	0
Redroot Pigweed	10
Soybean	0
Surinam Grass	10
Velvetleaf	0
Wild Poinsettia	0

TABLE E	COMPOUND
Rate 17 g/ha	41
PREEMERGENCE	
Arrowleaf Sida	0
Barnyardgrass	35
Cocklebur	-
Common Ragweed	10
Corn	0
Cotton	-
Fall Panicum	50
Field Bindweed	-
Fl Beggarweed	0
Giant Foxtail	70
Hairy Beggartic	0
Ivyleaf Mrnglry	0
Johnsongrass	0
Ladysthumb	-
Lambsquarters	-
Large Crabgrass	65
Purple Nutsedge	-
Redroot Pigweed	65
Soybean	-
Surinam Grass	10
Velvetleaf	0
Wild Poinsettia	0

TEST F

Plastic pots were partially filled with silt loam soil. The soil was then saturated with water. Rice (*Oryza sativa*) seed or seedlings at the 2.0 to 3.5 leaf stage; seeds tubers or plant parts selected from barnyardgrass (*Echinochloa crus-galli*), duck salad (*Heteranthera limosa*), early watergrass (*Echinochloa oryzoides*), junglerice (*Echinochloa colonum*), late watergrass (*Echinochloa oryzicola*), redstem (*Ammania* spp.), rice flatsedge (*Cyperus iria*), smallflower flatsedge (*Cyperus difformis*) and tighthead sprangletop (*Leptochloa fasicularis*), were planted into this soil. Plantings and waterings of these crops and weed species were adjusted to produce plants of appropriate size for the test. At the two leaf stage, water levels were raised to 3 cm above the soil surface and maintained at this level throughout the test. Chemical treatments were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied directly to the paddy water, by pipette, or to the plant foliage, by an air-pressure assisted, calibrated belt conveyer spray system.

Treated plants and controls were maintained in a greenhouse for approximately 21 days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table F, are reported on a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash (-) response means no test result.

TABLE F	COMPOUND
Rate 90 g/ha	69
PD/TA	
barnyardgrass	55
ducksalad	100
early watergrass	68
junglerice	-
late watergrass	35
redstem	98
rice flatsedge	95
smallflower flatsedge	95
tighthead sprangletop	43
2 LF direct seeded indica rice	-
2 LF transp. indica rice	30
2 LF transp. japonica rice	45

TABLE F	COMPOUND
Rate 375 g/ha	30
PD/TA	
barnyardgrass	55
ducksalad	90
early watergrass	60
junglerice	-
late watergrass	50
redstem	100
rice flatsedge	100
smallflower flatsedge	95
tighthead sprangletop	75
2 LF direct seeded indica rice	65
2 LF transp. indica rice	15
2 LF transp. japonica rice	-

TABLE F

Rate 64 g/ha	COMPOUND											
	9	11	22	24	25	30	41	42	43	44	69	73
PD/TA												
barnyardgrass	35	45	30	40	20	20	65	35	0	20	30	43
ducksalad	90	0	33	30	35	15	68	60	45	40	93	80
early watergrass	-	-	-	20	20	15	-	-	-	-	35	-
junglerice	-	-	68	45	-	-	-	70	0	0	-	-
late watergrass	50	20	23	35	10	25	0	20	10	0	20	50
redst m	65	75	0	65	45	45	58	45	35	0	85	85
rice flatsedge	65	85	75	100	100	70	53	-	-	-	80	60
smallflow r flatsedge	98	80	85	100	55	80	53	80	60	70	80	93
tighthead sprangletop	-	-	50	30	0	15	-	35	75	0	20	13
2 LF direct seeded indica rice	60	35	50	35	15	20	13	20	25	25	-	78
2 LF transp. indica rice	10	10	30	10	0	0	0	10	10	10	18	13
2 LF transp. japonica rice	-	-	-	-	-	-	-	-	-	-	25	-

TABLE F

Rate 250 g/ha	COMPOUND 9	11	20	21	22	24	25	30	41	42	43	44	69
PD/TA													
barnyardgrass	90	65	45	60	45	85	40	45	90	80	35	35	100
ducksalad	98	45	25	0	90	85	30	85	83	95	85	85	100
early watergrass	-	-	-	-	-	70	35	55	-	-	-	-	95
junglerice	-	-	60	70	83	100	-	-	-	100	30	85	-
late watergrass	100	85	58	50	48	80	25	40	100	60	20	15	90
redstem	80	95	100	95	95	85	95	100	90	85	80	60	100
rice flatsedge	85	98	85	0	100	100	95	90	88	-	-	-	100
smallflower flatsedge	98	95	85	28	90	95	85	90	93	90	85	95	100
tighthead sprangletop	-	-	65	75	75	65	20	30	-	90	80	50	90
2 LF direct seeded indica rice	95	75	60	65	75	70	35	60	38	60	40	60	-
2 LF transp. indica rice	50	35	40	45	43	45	10	10	13	30	20	20	75
2 LF transp. japonica rice	-	-	-	-	-	-	-	-	-	-	-	-	88

TABLE F

Rate 32 g/ha	COMPOUND					
	22	25	41	44	69	73
PD/TA						
barnyardgrass	35	15	5	10	23	20
ducksalad	0	0	48	35	85	70
early watergrass	-	20	-	-	25	-
junglerice	80	-	-	0	-	-
lat watergrass	5	10	0	0	18	0
redstem	0	35	13	0	65	78
rice flatsedge	18	100	73	-	65	45
smallfl wer flatsedge	75	30	18	80	65	88
tighthead sprangletop	53	20	-	0	0	0
2 LF direct seeded indica rice	30	10	0	20	-	13
2 LF transp. indica rice	20	10	0	0	10	0
2 LF transp. japonica rice	-	-	-	-	10	-

TABLE F

Rate 125 g/ha	COMPOUND													
	9	11	20	21	22	24	25	30	41	42	43	44	69	73
PD/TA														
barnyardgrass	85	80	25	30	45	70	35	35	85	45	30	30	88	83
ducksalad	85	40	0	0	90	95	40	30	70	85	50	55	100	98
early watergrass	-	-	-	-	-	40	35	40	-	-	-	-	100	-
junglerice	-	-	35	55	80	70	-	-	-	100	45	85	-	-
late wat rgrass	60	65	33	30	33	55	25	30	97	35	15	10	45	99
redstem	70	90	93	90	93	85	70	90	60	75	40	0	100	95
rice flatsedge	70	90	100	40	100	100	95	80	83	-	-	-	93	65
smallflower flatsedge	98	85	90	0	90	100	60	85	78	90	80	95	93	95
tighthead sprangletop	-	-	70	60	78	50	20	55	-	70	85	0	58	78
2 LF direct seeded indica rice	90	60	30	45	60	45	20	40	35	35	25	40	-	98
2 LF transp. indica rice	45	30	5	35	30	15	10	10	0	25	30	20	55	63
2 LF transp. japonica rice	-	-	-	-	-	-	-	-	-	-	-	-	68	-

TABLE F

Rate 16 g/ha	COMPOUND	
	22	73
PD/TA		
barnyardgrass	20	0
ducksalad	0	58
early watergrass	-	-
junglerice	73	-
late watergrass	8	0
redstem	10	18
rice flatsedge	0	38
smallfl wer flatsedge	65	78
tighth ad sprangletop	33	0
2 LF direct seeded indica rice	15	0
2 LF transp. indica rice	10	0
2 LF transp. japonica rice	-	-

TABLE F

Rate 8 g/ha	COMPOUND
	73
PD/TA	
barnyardgrass	0
ducksalad	30
early watergrass	-
junglerice	-
late watergrass	0
redstem	0
rice flatsedge	35
smallflower flatsedge	20
tighthead sprangletop	0
2 LF direct seeded indica rice	0
2 LF transp. indica rice	0
2 LF transp. japonica rice	-

TABLE F

	COMPOUND					
Rate 1000 g/ha	9	11	20	21	42	43
PD/TA						
barnyardgrass	98	100	65	70	85	60
ducksalad	100	85	68	25	100	100
early watergrass	-	-	-	-	-	-
junglerice	-	-	65	100	100	100
late watergrass	100	100	60	65	85	40
redstem	65	98	100	100	100	100
rice flatsedge	98	100	100	73	-	-
smallflower flatsedge	100	98	90	83	95	98
tighthead sprangletop	-	-	85	95	100	95
2 LF direct seeded indica rice	100	95	73	85	80	45
2 LF transp. indica rice	90	65	55	75	50	15
2 LF transp. japonica rice	-	-	-	-	-	-

TABLE F

Rate 500 g/haPD/TA	9	11	20	21	25	30	41	42	43	44
PD/TA										
barnyardgrass	95	100	63	65	45	65	95	85	45	40
ducksalad	100	90	55	0	95	95	88	100	98	100
early watergrass	-	-	-	-	40	65	-	-	-	-
jungl rice	-	-	60	75	-	-	-	100	85	100
late watergrass	100	100	55	60	55	80	100	75	30	20
redstem	50	95	100	98	95	95	95	90	100	80
rice flatsedge	100	100	100	73	100	100	93	-	-	-
smallflower flatsedge	98	98	90	65	90	95	95	95	95	95
tighth ad sprangletop	-	-	80	93	65	100	-	95	85	80
2 LF direct seeded indica rice	95	85	63	68	40	70	60	70	45	70
2 LF transp. indica rice	70	50	45	58	25	40	30	45	25	40
2 LF transp. japonica rice	-	-	-	-	-	-	-	-	-	-

TABLE F	COMPOUND
Rate 300 g/ha	24
PD/TA	
barnyardgrass	90
ducksalad	90
early watergrass	60
junglerice	100
late watergrass	85
redstem	90
rice flatsedge	100
smallflower flatsedge	95
tighthead sprangletop	65
2 LF direct seeded indica rice	75
2 LF transp. indica rice	55
2 LF transp. japonica rice	-

TABLE F	COMPOUND
Rate 200 g/ha	24
PD/TA	
barnyardgrass	80
ducksalad	90
early watergrass	70
junglerice	85
late watergrass	65
redstem	85
rice flatsedge	100
smallflower flatsedge	90
tighthead sprangletop	65
2 LF direct seeded indica rice	60
2 LF transp. indica rice	45
2 LF transp. japonica rice	-

TEST G

Seeds, tubers, or plant parts of alexandergrass (*Brachiaria plantaginea*), alfalfa (*Medicago sativa*), bermudagrass (*Cynodon dactylon*), broadleaf signalgrass (*Brachiaria platyphylla*), common purslane (*Portulaca oleracea*), common ragweed (*Ambrosia elatior*), cotton (*Gossypium hirsutum*), dallisgrass (*Paspalum dilatatum*), goosegrass (*Eleusine indica*), guineagrass (*Panicum maximum*), itchgrass (*Rottboellia exaltata*), johnsongrass (*Sorghum halepense*), large crabgrass (*Digitaria sanguinalis*), peanuts (*Arachis hypogaea*), pitted morningglory (*Ipomoea lacunosa*), purple nutsedge (*Cyperus rotundus*), sandbur (*Cenchrus echinatus*), sourgrass (*Trichachne insularis*), surinam grass (*Brachiaria decumbens*) and Texas panicum (*Panicum Texas*) were planted into greenhouse pots or flats containing greenhouse planting medium. Plant species were grown in separate pots or individual compartments. Test chemicals were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied preemergence and postemergence to the plants. Preemergence applications were made within one day of planting the seed or plant part. Postemergence applications were applied when the plants were in the two to four leaf stage (three to twenty cm).

Untreated control plants and treated plants were placed in the greenhouse and visually evaluated for injury 13 to 21 days after herbicide application. Plant response ratings, summarized in Table G, are based on a 0 to 100 scale where 0 is no injury and 100 is complete control. A dash (-) response means no test result.

TABLE G	COMPOUND	
Rate 250 g/ha	50	73
POSTEMERGENCE		
Alexandergrass	0	40
Alfalfa Var.	50	-
Bermudagrass	10	40
Brdlf Sgnlgrass	10	70
Cmn Purslane	50	15
Cmn Ragweed	65	50
Cotton	-	90
Dallisgrass	0	30
Goosegrass	5	50
Guineagrass	5	65
Itchgrass	5	20
Johnson grass	0	20
Large Crabgrass	0	40
Peanuts	10	50
Pit Morninglory	30	75
Purple Nutsedge	20	75
Sandbur	0	20
Sourgrass	0	20
Surinam grass	-	35
Texas Panicum	5	-

TABLE G	COMPOUND		
Rate 250 g/ha	3	50	73
PREEMERGENCE			
Alexandergrass	100	100	100
Alfalfa Var.	-	95	-
Bermudagrass	100	99	100
Brdlf Sgnlgrass	100	100	100
Cmn Purslane	100	100	100
Cmn Ragweed	100	98	100
Cotton	35	65	100
Dallisgrass	100	100	100
Goosegrass	100	99	100
Guineagrass	100	100	100
Itchgrass	90	53	75
Johnson grass	100	83	80
Large Crabgrass	100	99	100
Peanuts	35	50	30
Pit Morninglory	100	93	100
Purple Nutsedge	75	65	80
Sandbur	100	95	35
Sourgrass	100	100	100
Surinam grass	90	40	100
Texas Panicum	-	100	-

TABLE G	COMPOUND		
Rate 125 g/ha	3	35	46
POSTEMERGENCE			
Alexandergrass	10	0	75
Alfalfa Var.	10	-	20
Bermudagrass	0	5	100
Brdlf Sgnlgrass	30	60	100
Cmn Purslane	35	98	20
Cmn Ragweed	10	0	0
Cotton	-	35	-
Dallisgrass	0	15	98
Goosegrass	5	60	95
Guineagrass	20	75	80
Itchgrass	30	50	95
Johnson grass	70	65	100
Large Crabgrass	5	40	85
Peanuts	10	35	40
Pit Morninglory	20	90	0
Purple Nutsedge	20	20	10
Sandbur	0	35	98
Sourgrass	10	20	100
Surinam grass	-	15	-
Texas Panicum	5	-	100

TABLE G	COMPOUND			
Rate 125 g/ha	3	35	46	50
PREEMERGENCE				
Alexandergrass	80	10	0	100
Alfalfa Var.	100	-	0	-
Bermudagrass	100	80	100	100
Brdlf Sgnlgrass	90	100	90	95
Cmn Purslane	88	0	0	100
Cmn Ragweed	93	0	0	50
Cotton	5	0	-	35
Dallisgrass	100	0	80	100
Goosegrass	94	-	98	100
Guineagrass	100	-	95	100
Itchgrass	88	60	10	50
Johnson grass	95	35	0	80
Large Crabgrass	94	70	80	100
Peanuts	25	0	0	30
Pit Morninglory	95	80	0	98
Purple Nutsedge	50	0	100	75
Sandbur	85	20	-	35
Sourgrass	100	100	100	100
Surinam grass	60	5	-	35
Texas Panicum	98	-	90	-

TABLE G	COMPOUND	
Rate 64 g/ha	3	35
POSTEMERGENCE		
Alexandergrass	0	0
Alfalfa Var.	-	-
Bermudagrass	40	0
Brdlf Sgnlgrass	75	10
Cmn Purslane	30	98
Cmn Ragweed	10	0
Cotton	15	20
Dallisgrass	65	0
Goosegrass	50	10
Guineagrass	25	10
Itchgrass	20	10
Johnson grass	20	10
Large Crabgrass	10	10
Peanuts	10	20
Pit Morninglory	60	70
Purple Nutsedge	35	5
Sandbur	5	0
Sourgrass	15	10
Surinam grass	10	10
Texas Panicum	-	-

TABLE G	COMPOUND		
Rate 64 g/ha	3	35	50
PREEMERGENCE			
Alexandergrass	40	10	70
Alfalfa Var.	-	-	-
Bermudagrass	93	85	100
Brdlf Sgnlgrass	78	10	100
Cmn Purslane	65	0	100
Cmn Ragweed	85	0	50
Cotton	5	0	10
Dallisgrass	53	-	100
Goosegrass	94	-	100
Guineagrass	100	-	90
Itchgrass	63	30	35
Johnson grass	73	20	60
Large Crabgrass	94	10	100
Peanuts	15	0	10
Pit Morninglory	28	65	80
Purple Nutsedge	30	0	50
Sandbur	13	0	50
Sourgrass	100	100	100
Surinam grass	20	0	30
Texas Panicum	-	-	-

TABLE G	COMPOUND
Rate 32 g/ha	35
POSTEMERGENCE	
Alexandergrass	0
Alfalfa Var.	-
Bermudagrass	0
Brdlf Sgnlgrass	0
Cmn Purslane	30
Cmn Ragweed	0
Cotton	0
Dallisgrass	0
Goosegrass	0
Guineagrass	10
Itchgrass	0
Johnson grass	0
Large Crabgrass	0
Peanuts	10
Pit Morninglory	10
Purple Nutsedge	0
Sandbur	0
Sourgrass	0
Surinam grass	0
Texas Panicum	-

TABLE G	COMPOUND		
Rate 32 g/ha	3	35	50
PREEMERGENCE			
Alexandergrass	0	5	20
Alfalfa Var.	-	-	-
Bermudagrass	0	0	100
Brdlf Sgnlgrass	30	0	75
Cmn Purslane	60	0	80
Cmn Ragweed	20	0	50
Cotton	0	0	0
Dallisgrass	10	0	0
Goosegrass	65	-	95
Guineagrass	65	-	100
Itchgrass	35	50	35
Johnson grass	40	0	65
Large Crabgrass	20	0	90
Peanuts	0	0	0
Pit Morninglory	0	0	75
Purple Nutsedge	0	0	10
Sandbur	0	0	0
Sourgrass	90	0	100
Surinam grass	0	0	10
Texas Panicum	-	-	-

TEST H

Compounds evaluated in this test were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied to the soil surface before plant seedlings emerged (preemergence application) and to plants that were in the one-to four leaf stage (postemergence application). A sandy loam soil was used for the preemergence test while a mixture of sandy loam soil and greenhouse potting mix in a 60:40 ratio was used for the postemergence test. Test compounds were applied within approximately one day after planting seeds for the preemergence test.

Plantings of these crops and weed species were adjusted to produce plants of appropriate size for the postemergence test. All plant species were grown using normal greenhouse practices. Crop and weed species include annual bluegrass (*Poa annua*), black nightshade (*Solanum nigrum*), blackgrass (*Alopecurus myosuroides*), chickweed (*Stellaria media*), deadnettle (*Lamium amplexicaule*), downy brome (*Bromus tectorum*), field violet (*Viola arvensis*), galium (*Galium aparine*), green foxtail (*Setaria viridis*), jointed goatgrass (*Aegilops cylindrica*), kochia (*Kochia scoparia*), lambsquarters (*Chenopodium album*), littleseed canarygrass (*Phalaris minor*), rape (*Brassica napus*), redroot pigweed (*Amaranthus retroflexus*), ryegrass (*Lolium multiflorum*), scentless chamomile (*Matricaria inodora*), speedwell (*Veronica persica*), spring barley (*Hordeum vulgare* cv. 'Klages'), spring wheat (*Triticum aestivum* cv. 'ERA'), sugar beet (*Beta vulgaris* cv. 'US1'), sunflower (*Helianthus annuus* cv. 'Russian Giant'), wild buckwheat (*Polygonum convolvulus*), wild mustard (*Sinapis arvensis*), wild oat (*Avena fatua*), windgrass (*Apera spica-venti*), winter barley (*Hordeum vulgare* cv. 'Igri') and winter wheat (*Triticum aestivum* cv. 'Talent'). Wild oat was treated at two growth stages. The first stage (1) was when the plant had two to three leaves. The second stage (2) was when the plant had approximately four leaves or in the initial stages of tillering.

Treated plants and untreated controls were maintained in a greenhouse for approximately 21 to 28 days, after which all treated plants were compared to untreated controls and visually evaluated. Plant response ratings, summarized in Table H, are based upon a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash response (-) means no test result.

TABLE H	COMPOUND
Rate 250 g/ha	69
POSTEMERGENCE	
Annual Bluegrass	70
Blackgrass	40
Blk Nightshade	75
Chickweed	65
Deadnettle	75
Downy brome	0
Field violet	65
Galium	70
Jointed Goatgra	20
Kochia	75
Lambsquarters	95
LS Canarygrass	15
Rape	65
Redroot Pigweed	75
Ryegrass	20
Scentless Chamon	40
Speedwell	70
Spring Barley	20
Sugar beet	85
Sunflower	20
Wheat (Spring)	10
Wheat (Winter)	10
Wild buckwheat	15
Wild mustard	100
Wild oat (1)	25
Wild oat (2)	15
Winter Barley	20

TABLE H	COMPOUND
Rate 250 g/ha	69
PREEMERGENCE	
Annual Bluegrass	100
Blackgrass	100
Blk Nightshade	95
Chickweed	65
Deadnettle	100
Downy brome	30
Field violet	80
Galium	100
Green foxtail	100
Jointed Goatgra	75
Kochia	80
Lambsquarters	70
LS Canarygrass	100
Rape	100
Redroot Pigweed	40
Ryegrass	50
Speedwell	100
Spring Barley	40
Sugar beet	100
Sunflower	30
Wheat (Spring)	20
Wheat (Winter)	20
Wild buckwheat	20
Wild mustard	100
Wild oat (1)	75
Windgrass	70
Winter Barley	40

TABLE H	COMPOUND						
Rate 125 g/ha	47	48	58	61	68	69	77
POSTEMERGENCE							
Annual Bluegrass	-	-	30	-	60	60	40
Blackgrass	-	-	25	-	35	30	25
Blk Nightshade	65	80	70	100	100	75	65
Chickweed	25	35	30	100	65	35	20
Deadnettle	70	85	50	100	75	65	55
Downy brome	-	-	5	-	15	10	0
Field violet	40	80	65	100	75	65	65
Galium	40	65	55	100	70	60	55
Jointed Goatgra	-	-	10	-	20	20	20
Kochia	35	85	80	100	75	75	70
Lambsquarters	65	90	60	100	100	100	75
LS Canarygrass	-	-	10	-	20	10	10
Rape	-	-	65	-	75	65	60
Redroot Pigweed	20	85	75	100	75	65	70
Ryegrass	-	-	5	-	20	5	10
Scentless Chamon	15	35	30	100	55	20	45
Speedwell	70	100	55	100	100	65	55
Spring Barley	0	0	5	80	20	20	30
Sugar beet	-	-	75	-	100	75	70
Sunflower	-	-	20	-	40	10	25
Wheat (Spring)	0	0	25	75	20	10	0
Wheat (Winter)	0	0	10	65	20	10	5
Wild buckwheat	25	30	45	100	60	30	30
Wild mustard	-	-	65	-	100	85	50
Wild oat (1)	-	-	10	-	30	15	10
Wild oat (2)	-	-	10	-	20	10	10
Winter Barley	0	0	25	70	30	20	25

TABLE H	COMPOUND	
Rate 125 g/ha	68	69
PREEMERGENCE		
Annual Bluegrass	85	100
Blackgrass	100	100
Blk Nightshade	90	75
Chickweed	75	75
Deadnettle	100	100
Downy brome	20	20
Field violet	80	85
Galium	100	100
Green foxtail	100	100
Jointed Goatgra	30	75
Kochia	60	70
Lambsquarters	85	70
LS Canarygrass	40	80
Rape	65	85
Redroot Pigweed	50	85
Ryegrass	40	30
Speedwell	95	85
Spring Barley	40	15
Sugar beet	100	100
Sunflower	30	20
Wheat (Spring)	40	10
Wheat (Winter)	20	10
Wild buckwheat	100	85
Wild mustard	100	100
Wild oat (1)	10	30
Windgrass	30	40
Winter Barley	35	10

TABLE H	COMPOUND						
Rate 62 g/ha	47	48	58	61	68	69	77
POSTEMERGENCE							
Annual Bluegrass	-	-	10	-	20	30	20
Blackgrass	-	-	10	-	20	20	10
Blk Nightshade	65	65	50	35	70	65	55
Chickweed	20	20	50	20	55	35	45
Deadnettle	70	65	30	70	50	40	30
Downy brome	-	-	0	-	10	20	10
Field violet	30	70	60	20	60	55	50
Galium	65	35	35	65	60	65	50
Jointed Goatgra	-	-	0	-	20	10	15
Kochia	35	70	75	40	75	70	55
Lambsquarters	40	85	60	60	80	75	60
LS Canarygrass	-	-	5	-	10	20	10
Rape	-	-	50	-	75	55	35
Redroot Pigweed	10	75	65	25	75	65	75
Ryegrass	-	-	5	-	10	0	10
Scentless Chamon	0	30	10	10	35	20	30
Speedwell	60	90	50	70	75	55	45
Spring Barley	0	0	10	0	20	10	10
Sugar beet	-	-	65	-	100	70	50
Sunflower	-	-	10	-	30	20	15
Wheat (Spring)	0	0	10	0	15	10	0
Wheat (Winter)	0	0	10	0	15	0	0
Wild buckwheat	20	70	65	30	30	10	20
Wild mustard	-	-	30	-	100	55	30
Wild oat (1)	-	-	10	-	20	10	10
Wild oat (2)	-	-	0	-	15	10	0
Winter Barley	0	0	10	0	20	25	10

TABLE H	COMPOUND	
Rate 62 g/ha	68	69
PREEMERGENCE		
Annual Bluegrass	75	85
Blackgrass	100	85
Blk Nightshade	30	85
Chickweed	40	50
Deadnettle	80	100
Downy brome	10	10
Field violet	60	40
Galium	80	100
Green foxtail	100	100
Jointed Goatgra	20	20
Kochia	85	30
Lambsquarters	70	70
LS Canarygrass	20	80
Rape	50	80
Redroot Pigweed	70	60
Ryegrass	30	50
Speedwell	100	60
Spring Barley	10	20
Sugar beet	100	80
Sunflower	35	20
Wheat (Spring)	0	10
Wheat (Winter)	10	10
Wild buckwheat	40	100
Wild mustard	100	100
Wild oat (1)	20	20
Windgrass	20	30
Winter Barley	20	50

TABLE H	COMPOUND
Rate 31 g/ha	68
POSTEMERGENCE	
Annual Bluegrass	10
Blackgrass	15
Blk Nightshade	50
Chickweed	30
Deadnettle	40
Downy brome	10
Field violet	60
Galium	50
Jointed Goatgra	15
Kochia	70
Lambsquarters	100
LS Canarygrass	0
Rape	60
Redroot Pigweed	70
Ryegrass	10
Scentless Chamon	30
Speedwell	60
Spring Barley	10
Sugar beet	85
Sunflower	15
Wheat (Spring)	10
Wheat (Winter)	10
Wild buckwheat	65
Wild mustard	65
Wild oat (1)	10
Wild oat (2)	10
Winter Barley	10

TABLE H	COMPOUND
Rate 31 g/ha	68
PREEMERGENCE	
Annual Bluegrass	20
Blackgrass	85
Blk Nightshade	30
Chickweed	50
Deadnettle	60
Downy brome	10
Field violet	40
Galium	100
Green foxtail	85
Jointed Goatgra	10
Kochia	85
Lambsquarters	70
LS Canarygrass	10
Rape	35
Redroot Pigweed	70
Ryegrass	10
Speedwell	75
Spring Barley	10
Sugar beet	60
Sunflower	20
Wheat (Spring)	0
Wheat (Winter)	0
Wild buckwheat	40
Wild mustard	100
Wild oat (1)	10
Windgrass	10
Winter Barley	10

TEST I

Compounds evaluated in this test were formulated in a non-phytotoxic solvent mixture which includes a surfactant and applied to the soil surface before plant seedlings emerged (preemergence application) and to plants that were grown for various periods of time before treatment (postemergence application). A sandy loam soil was used for the preemergence test while a mixture of sandy loam soil and greenhouse potting mix in a 60:40 ratio was used for the postemergence test. Test compounds were applied within approximately one day after planting seeds for the preemergence test, and 13 days after the last postemergence planting.

Plantings of these crops and weed species were adjusted to produce plants of appropriate size for the postemergence test. All plant species were grown using normal greenhouse practices. Crop and weed species include alexandergrass (*Brachiaria plantaginea*), american black nightshade (*Solanum americanum*), apple-of-Peru (*Nicandra physaloides*), arrowleaf sida (*Sida rhombifolia*), brazilian sicklepod (*Cassia tora Brazilian*), brazilian signalgrass (*Brachiaria decumbens*), capim-colchao (*Digitaria horizontalis*), cristalina soybean (*Glycine max Cristalina*), florida beggarweed (*Desmodium purpureum*), hairy beggarticks (*Bidens pilosa*), slender amaranth (*Amaranthus viridis*), southern sandbur (*Cenchrus echinatus*), tall morningglory (*Ipomoea purpurea*), tropical spiderwort (*Commelina benghalensis*), W20 Soybean (*Glycine max* W20), W4-4 Soybean (*Glycine max* W4-4) and wild poinsettia (*Eupohorbia heterophylla*).

Treated plants and untreated controls were maintained in a greenhouse for approximately 13 days, after which all treated plants were compared to untreated controls and visually evaluated. Plant response ratings, summarized in Table I, are based upon a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash response (-) means no test result.

TABLE I	COMPOUND	
Rate 560 g/ha	41	42
PREEMERGENCE		
Alexandergrass	100	100
Apple-of-Peru	50	30
Arrowleaf Sida	80	65
B. Signalgrass	100	100
Bl. Nightshade	100	70
Braz Sicklepod	55	100
Capim-Colchao	100	100
Crist. Soybean	40	50
Fl. Beggarweed	100	60
H. Beggarticks	100	25
Morningglory	100	100
Sl. Amaranth	100	100
Southern Sandur	100	100
Tr. Spiderwort	100	75
Wld Pointsettia	50	50
W20 Soybean	15	50
W4-4 Soybean	25	50

TABLE I	COMPOUND	
Rate 280 g/ha	41	42
PREEMERGENCE		
Alexandergrass	100	100
Apple-of-Peru	10	20
Arrowleaf Sida	70	60
B. Signalgrass	100	100
Bl. Nightshade	100	60
Braz Sicklepod	40	70
Capim-Colchao	100	70
Crist. Soybean	40	50
Fl. Beggarweed	100	60
H. Beggarticks	75	25
Morningglory	-	60
Sl. Amaranth	100	100
Southern Sandur	90	85
Tr. Spiderwort	100	20
Wld Pointsettia	0	50
W20 Soybean	15	40
W4-4 Soybean	25	40

TABLE I	COMPOUND	
Rate 140 g/ha	41	42
PREEMERGENCE		
Alexandergrass	100	100
Apple-of-Peru	0	10
Arrowleaf Sida	70	50
B. Signalgrass	85	85
Bl. Nightshade	85	60
Braz Sicklepod	40	30
Capim-Colchao	100	70
Crist. Soybean	25	30
Fl. Beggarweed	100	60
H. Beggarticks	70	20
Morningglory	70	60
Sl. Amaranth	100	100
Southern Sandur	80	80
Tr. Spiderwort	55	20
Wld Pointsettia	0	45
W20 Soybean	15	25
W4-4 Soybean	20	40

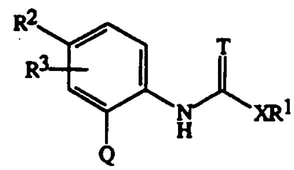
TABLE I	COMPOUND	
Rate 70 g/ha	41	42
PREEMERGENCE		
Alexandergrass	80	50
Apple-of-Peru	0	0
Arrowleaf Sida	60	50
B. Signalgrass	70	65
Bl. Nightshade	75	20
Braz Sicklepod	0	10
Capim-Colchao	100	70
Crist. Soybean	10	25
Fl. Beggarweed	100	-
H. Beggarticks	-	20
Morningglory	60	50
Sl. Amaranth	100	20
Southern Sandur	55	50
Tr. Spiderwort	55	0
Wld Pointsettia	0	45
W20 Soybean	10	20
W4-4 Soybean	20	15

TABLE I	COMPOUND
Rate 35 g/ha	42
PREEMERGENCE	
Alexandergrass	45
Apple-of-Peru	0
Arrowleaf Sida	50
B. Signalgrass	50
Bl. Nightshade	20
Braz Sicklepod	0
Capim-Colchao	70
Crist. Soybean	25
Fl. Beggarweed	-
H. Beggarticks	20
Morningglory	40
Sl. Amaranth	15
Southern Sandur	40
Tr. Spiderwort	0
Wld Pointsettia	0
W20 Soybean	15
W4-4 Soybean	10

CLAIMS

What is claimed is:

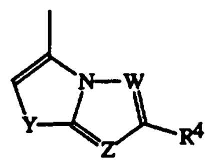
1. A compound selected from Formula I, *N*-oxides and agriculturally-suitable salts thereof,



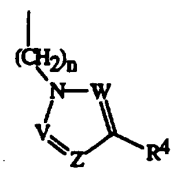
I

wherein

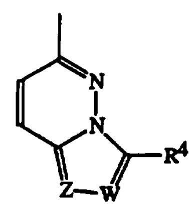
Q is



Q-1



Q-2



Q-3

T is O or S;

X is a single bond, O, S, or NR^5;

Y is O, S, NR^6, -CH=CH-, or -CH=N-, where the -CH=N- can be attached in either possible orientation;

Z is CH or N;

W is CH or N;

V is CH, CCH_3 or N, provided that V is CH or CCH_3 when W is CH;

R^1 is C_1-C_5 alkyl optionally substituted with C_1-C_2 alkoxy, OH, 1-7 halogen, or C_1-C_2 alkylthio; CH_2(C_3-C_4 cycloalkyl); C_3-C_6 cycloalkyl optionally substituted with 1-3 halogen or 1-4 methyl groups; C_2-C_4 alkenyl; C_2-C_4 haloalkenyl; or phenyl optionally substituted with C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy, 1-2 halogen, nitro, or cyano; provided that when X is O, S, or NR^5, then R^1 is other than C_2 alkenyl and C_2 haloalkenyl;

R^2 is H, halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, C_1-C_2 alkylthio, C_2-C_3 alkoxyalkyl, C_2-C_3 alkylthioalkyl, cyano, nitro, NH(C_1-C_2 alkyl), or N(C_1-C_2 alkyl)$_2$;

R^3 is H, halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, C_1-C_2 alkylthio, C_2-C_3 alkoxyalkyl, C_2-C_3 alkylthioalkyl, cyano, nitro, NH(C_1-C_2 alkyl), or N(C_1-C_2 alkyl)$_2$;

R^4 is C_1-C_4 haloalkyl, C_1-C_4 haloalkoxy, C_1-C_4 haloalkylthio, C_1-C_4 alkylsulfonyl, C_1-C_4 haloalkylsulfonyl, halogen, cyano, or nitro;

R^5 is H, CH_3, or OCH_3;

R^6 is H or CH_3; and

n is 0 or 1.

2. A compound of Claim 1 wherein:

R^1 is C_1-C_4 alkyl optionally substituted with methoxy or 1-3 halogen; C_3-C_4 cycloalkyl optionally substituted with one methyl group; C_2-C_4 alkenyl; or C_2-C_4 haloalkenyl;

R^2 is chlorine, bromine, C_1-C_2 alkyl, C_1-C_2 alkoxy, cyano, nitro, $NH(C_1$-C_2 alkyl), or $N(C_1$-C_2 alkyl$)_2$; and

R^3 is H.

3. A compound of Claim 2 wherein:

X is a single bond; and

R^4 is C_1-C_2 haloalkyl, C_1-C_2 haloalkoxy, C_1-C_2 haloalkylthio, chlorine, or bromine.

4. A compound of Claim 3 wherein:

Q is Q-1.

5. A compound of Claim 3 wherein:

Q is Q-2.

6. A compound of Claim 3 wherein:

Q is Q-3.

7. The compound of Claim 3 which is selected from the group:

3-methyl-*N*-[4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]phenyl]butanamide;

N-[4-methyl-2-[2-(trifluoromethyl)thiazolo[3,2-*b*][1,2,4]triazol-6-yl]phenyl]cyclopropanecarboxamide;

2-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]propanamide;

N-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]cyclopropanecarboxamide;

3-methyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]butanamide;

2-methyl-*N*-[4-methyl-2-[[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]methyl]phenyl]propanamide; and

2,2-dimethyl-*N*-[4-methyl-2-[3-(trifluoromethyl)-1,2,4-triazolo[4,3-*b*]pyridazin-6-yl]phenyl]propanamide.

8. A herbicidal composition comprising a herbicidally effective amount of a compound of Claim 1 and at least one of a surfactant, a solid diluent or a liquid diluent.

9. A method for controlling the growth of undesired vegetation comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of Claim 1.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 96/03803

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C07D513/04 A01N43/90 C07D231/12 C07D249/08 C07D487/04
C07D231/16 C07D249/10 //(C07D513/04,277:00,249:00),
(C07D487/04,249:00,237:00)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C07D A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO,A,93 11097 (DU PONT) 10 June 1993 cited in the application see meaning of Q-1 (page 2) ---	1-9
A	EP,A,0 244 098 (SCHERING AGROCHEMICALS LTD) 4 November 1987 see abstract ---	1-9
A	US,A,4 810 282 (RORER MORRIS P) 7 March 1989 see formula I (column 2) ---	1-9
A	EP,A,0 353 902 (DU PONT) 7 February 1990 see formula I (page 4) --- -/--	1-9

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 July 1996	14.08.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Steendijk, M

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 96/03803

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE WPI Section Ch, Week 9019 Derwent Publications Ltd., London, GB; Class C02, AN 90-144329 XP002009476 & JP,A,02 091 062 (KUMIAI CHEM IND KK) , 30 March 1990 see abstract ---	1-7
A	US,A,4 236 015 (LUBER EDWARD J JR ET AL) 25 November 1980 see abstract ---	1-7
P,Y	WO,A,95 09846 (DU PONT ;DENES LUCIAN RADU (US)) 13 April 1995 see formula I (page 1) -----	1-9

1

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PCT/US 96/03803

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Form PCT/ISA/210 (patent family annex) (July 1992)

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Information on patent family members

International Application No
PCT/US 96/03803

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